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Electrical World

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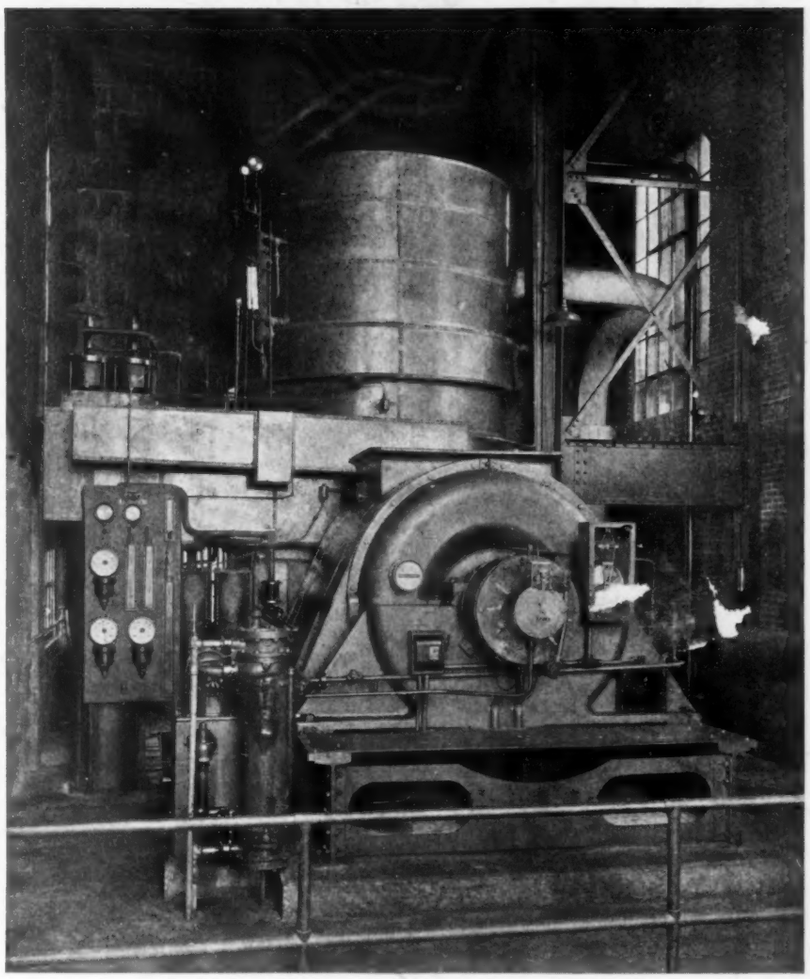

A New Type of Prime Mover Unit

Mercury Boiler and Turbine Now Operating in Hartford Electric Light Co. Plant

Selection and Layout of Steam Plant Auxiliaries
C. D. Gray and M. M. Samuels

Regulation of High-Voltage Lines
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Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

Published by McGraw-Hill Company, Inc.

W. H. ONKEN, JR. Editor — HAROLD V. BOZELL Editor

Volume 82 — New York, Saturday, October 13, 1923 — *Number* 15

Another Result of Misinformation

NO OTHER reason than that it is a result of misguided judgment caused by misinformation can be ascribed for the resolution passed on Oct. 5, at Portland, Ore., by the American Federation of Labor favoring federal and state ownership and control of all hydro-electric systems. The action of the same body on Monday, Oct. 8, in removing from its ranks a man whose principles were un-American adds to confidence in the purposes and sincerity of the federation as an institution of well-intentioned American citizens.

Yet these men profess to believe that they and the country at large would be better off with government-owned hydro-electric systems, and their expressed opinion is not a pretense, but a conviction based on misinformation. This is an added indication that the electrical industry collectively, and the companies which compose it individually, have still a great task to perform in educating the public to grasp the facts in the case. There are always those whose selfish purposes will lead them to be on hand to give misinformation.

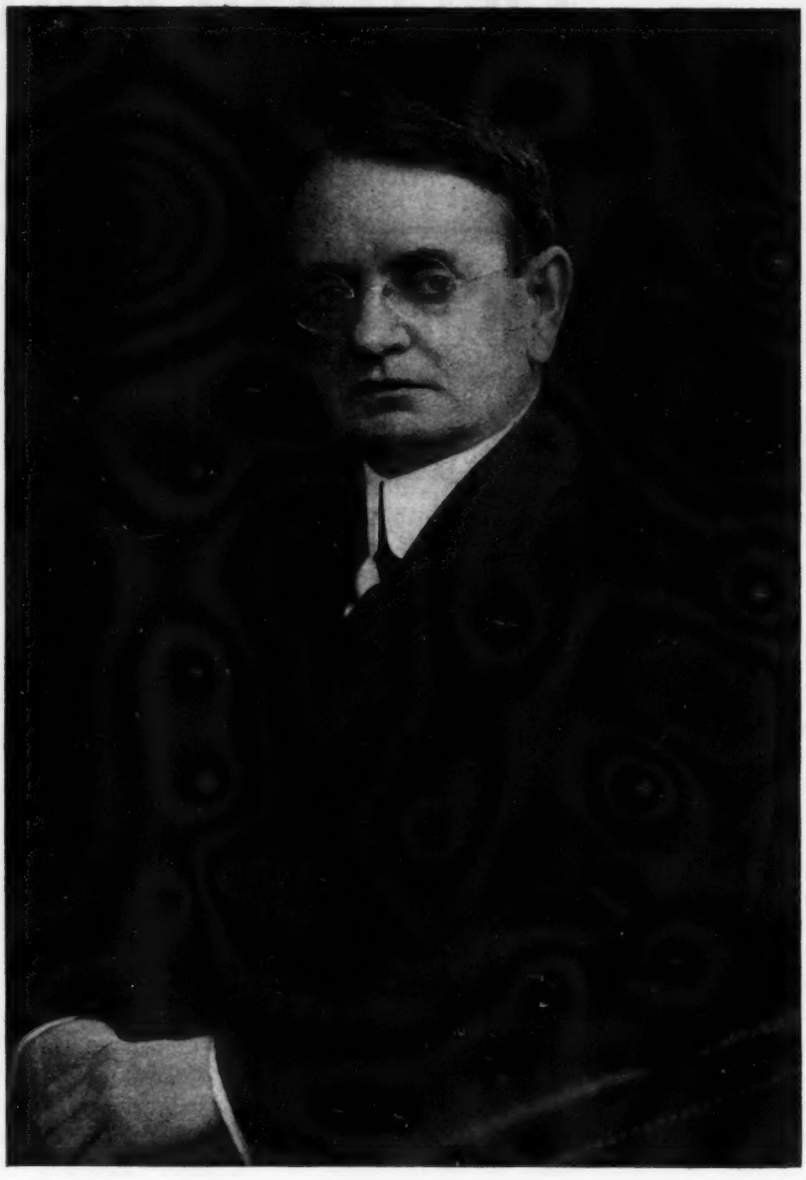
Experience has shown that a stable utility industry is the public's best assurance of a dependable service at reasonable cost. Experience has also shown that waterpower cannot be considered alone—it is not the only element in assuring an adequate supply of electrical energy. Steam power will always play an important if not the major rôle in that regard. The practical problems of interconnection and of operation must all be considered. And the inter-relation of these various factors are most important in the consideration of what agency is best fitted to conduct the electrical supply business. A large amount of interconnection has already been effected by the utilities to gain economies and give better service. It is facts such as these that must be brought home to the public in order that the public will take intelligent action. Resolutions of the kind reported, while in themselves not directly potent to do damage, do indicate an existing tendency in some quarters and serve to set precedents which may later produce a serious problem for the entire electrical industry—central stations, manufacturers, jobbers or others—as well as for the consumer and the public at large.

It is an industry-wide problem. Among central-station men it has been discussed and its seriousness appreciated, and action has started in some places. Affiliated interests, such as manufacturers, jobbers, contractors and dealers, do not seem to comprehend the situation so well. It is important that they be shown that every component part of the industry owes it to itself, to the industry and to the public to bring these problems before its national organization in such a way that concerted action can be taken. Utility information bureaus are doing excellent work, but they cannot succeed alone. Their activities must be supplemented by the action of companies locally, and above all by every utility employee.

The desire of every one is the same—to insure an adequate electrical development, to bring dependable service to all at reasonable cost. The problem is a huge one. Many groups which themselves have no first-hand information are studying it and acting on it. The question of moment is to see that they are correctly informed and that they do not act on misinformation.

Howard Saunders Warren

A telephone engineer who has been largely responsible for the development of loading and repeating coils and in addition ranks as an expert in inductive co-ordination work.



IT SPEAKS well for the co-operative spirit that exists in the electrical engineering profession to find that many expert telephone engineers find time to work cordially with other engineers in the industry to bring about a greater degree of co-ordination in those aspects of commercial development which involve controversial engineering and commercial elements.

Howard Saunders Warren became an expert on "loaded" circuits with the telephone industry. He designed the loading coils, superintended their manufacture and did the engineering of the first commercially successful installations both on cables and on open-wire circuits. He invented the very useful "terminal taper" device whereby reflection losses between loaded and non-loaded circuits may be overcome. The design and construction of successful phantom repeating coils formed another notable contribution from Mr. Warren.

Since 1907, however, Mr. Warren's time has been largely taken up with problems of electrical protection and inductive co-ordination. From 1912 to 1915 he was very active in the California investigations of inductive phenomena. The inductive-co-ordination features associated with the electrification of the New Haven, Pennsylvania, Norfolk & Western and other roads were handled by Mr. Warren, and his activities along these lines have been continued through his active participation in the work of the joint general committee on inductive co-ordination.

Born March 3, 1873, at Oldtown, Me., Mr. Warren attended the public schools at Dedham, Me., and the East Maine Conference Seminary at Bucksport, after which he took the engineering course at Leland Stanford University. After receiving his degree in 1898 he worked successively as electrician with the United States Fur Seal Commission, engineer with the Standard Electric Company, engineer with the California State Board of Harbor Commissioners and engineer with the Nevada County Electric Power Company.

With this varied experience behind him, Mr. Warren entered the employ of the American Bell Telephone Company and has retained his connection with that company and its successor since September, 1899. His contribution to the commercial and engineering developments of the company and his ability as an administrator caused him to be placed in charge of the subdepartment of transmission in the engineering department in 1903, and in 1905, when H. V. Hayes became chief engineer, Mr. Warren succeeded to Mr. Hayes' former position, in charge of equipment.

Editorial Comment

Electrical World, October 13, 1923

Volume 82 Number 15

How to Approach the Public School

THE public schools offer a very great opportunity for the education of the general public to a greater knowledge of electricity and what it means in the world today. But lamentably small progress seems to be made from year to year in the development of this ever-present and promising contact. What can be done by the central-station company actually to get the schools throughout the country properly equipped and more liberally minded toward the teaching of this very practical subject of electricity in daily living?

At a recent gathering of electrical men a guest, an advertising man, rose during the discussion and said that he was on the school board of an Eastern city and that the trouble was largely a matter of approach. The electrical industry, he said, has merely tried to sell light and power to a school. It has failed to look at the problem from the school board's viewpoint. In his opinion, a complete and definite proposition should be put up to the school board of every city, showing what part electrical applications have in education and what should be done for the electrical equipment of domestic science and physics classrooms.

The opportunity, of course, is larger than the mere sale of energy. Here are gathered the plastic minds of our youths, from whom will come the next generation of the consumers of central-station service. Public relations a few years hence will be vitally concerned with these youngsters now in the school. If it could so be that in the natural course of their education they could become familiar with the electric meter and the figuring of rates and bills and appreciate the functions of the modern public utility in our social and civic structure, it would prevent many of the misunderstandings and antipathies that now hamper electrical market development. If also they should learn the use and value of all kinds of household electrical equipment, the influence upon them and their parents would be great.

Higher Pressures May Reduce Obsolescence

ONE ELEMENT introduced by the adoption of high-pressure boilers and turbines in connection with existing stations is that this practice offers encouragement for postponing the time when many low-pressure stations will become obsolete. The use of the new high-pressure units in such a way as to superimpose them on existing moderate-pressure equipment will increase the station capacity without greatly increasing the investment and in addition will add greatly to the thermal efficiencies of the stations. If the new developments prove successful, it seems very probable that many stations, now rapidly becoming obsolete because of low thermal economy resulting from the use of low pressures, will gain a new lease of life at a minimum of expense.

A still further use of this principle of superimposing high-pressure systems on low-pressure stations is suggested by the Benson system of generating steam at about 3,200 pounds. This scheme is simple in principle in that water is raised to the desired pressure and is then heated as it flows through a steel coil of small diameter. After passing through a superheater it then is throttled and exhausted as slightly superheated steam at a pressure of about 1,500 pounds per square inch. It then goes through a superheater and to a high-pressure turbine and can be exhausted at a moderate pressure to operate in conjunction with the steam produced in the main boiler plant.

The history of the development of central-station power production includes records of many changes of method and equipment and shows case after case of obsolescence due to improvement in the art. The accounting and financial problems thus introduced have not been minor ones. It will surely be a sincerely welcomed condition if future improvements in central-station power production are all in the direction of superimposing the new equipment on existing plants, thereby extending indefinitely their useful life.

Increase Net Revenue by Intense Cultivation of Old Fields

THE opportunity of the central-station company for growth lies not only in the new fields for electrical energy but also in the many old fields that have not become saturated. For example, in a recent report to the National Electric Light Association, M. Luckiesh presents an extensive analysis of the residence lighting field which shows that the average wired home, in order to enjoy the full convenience and comfort of adequate lighting, needs 250 per cent more convenience outlets, 400 per cent more portable lamps, 250 per cent more wall brackets, 120 per cent more wattage of lamps and 50 per cent more electrical energy for lighting. The seventeen million homes that are not yet wired need all this plus about twice what the nine million homes already have. This total figured conservatively means billions of dollars' worth of business in permanent lighting equipment and about one billion dollars per year in additional revenue to central-station companies for electrical energy consumed in the proper lighting of homes. Certainly, the central station must eventually supply this 50 per cent increase in energy to the average wired home, and the resultant net revenue is an interesting subject for speculation.

A manager of an electric light and power company recently asserted that the average residence, consuming 350 kw.-hr. per annum at an 8-cent rate, was a source of a net profit per year of $2.50. After taking into consideration all charges, he found that an additional 100 kw.-hr. meant an additional net profit of $4.56, or a total of $7.06 instead of the original total of $2.50. Accepting both the statement mentioned above, that the average home should consume 50 per cent more electrical energy than at present in order to enjoy adequate

utilitarian lighting, and the foregoing computation of additional revenue, it is seen that the total net profit per annum from each home enjoying satisfactory utilitarian lighting would be $10.50 instead of $2.50.

The central-station company that does not interest itself in lighting the home adequately is neglecting not only the householder but its own prosperity as well. If these computations are borne out in practice, 50 per cent increase in electrical energy consumed will result in more than 300 per cent increase in net revenue. Of course, there would be readjustments in rates, but fortunately they would be of the character that meet with popular approval.

Interconnection and Droughts

IT IS too early to estimate the value of interconnections this year to electric light and power companies in areas suffering from almost unprecedented drought, but when the totals for 1923 come in covering energy sales by steam plants to hydro-electric networks and vice versa one may safely look for record-breaking economies in the use of fuel, remarkable savings in the use of capital and extraordinary benefits to the public. The popularity of intersystem tie lines developed with immense rapidity during the war, and the ability of adjoining and adjacent systems to meet fluctuating demands for power during the early post-war period through interconnection was also a factor potent for public welfare. Steady increase in interchanged energy has now reached a volume of intercompany service that has done yeoman duty in overcoming the difficulties arising from such a drought as New England in particular has been obliged to face since early summer.

In so-called normal years the diversity of flow between different watersheds renders the interconnection of hydro-electric plants of much value. This is the year of the steam plant in the Northeast, however, and during the current dry spell its interconnection with both steam and water-power systems signifies service of fundamental importance. In some parts of New England the output of the steam-driven central station has risen 50 to 100 per cent above that of a year ago, and in some localities a very large part of this increase is due to sales to other utilities at present severely handicapped by low water at their hydro-electric stations. The drought has stimulated engineering advance along the line of increased reservoir construction, but more immediate relief has come from the larger steam stations.

The cost of this power is a pretty substantial total in the hydro-electric companies' 1923 operating expenses. But, first and foremost, the demands of the public have very generally been met without curtailment of service, and, second, this regional service has undoubtedly been rendered as a whole with marked savings in total cost as compared with the expense incurred in former days by trying to meet such situations with the equipment and methods of isolated systems. The multiplication of small and inefficient steam plants has been virtually stopped; existing plant and line resources have been worked with a keen eye to changing and far-flung load requirements, and, in a word, fuel, labor and capital have been conserved on a large scale. Nothing within the past decade has accomplished more than interconnection to improve the control exercised by the operating engineer over the load supply of wide areas for the mutual benefit of the public and the utilities serving it.

The Code Advances— Give Its Changes Official Status

ONE of the features of the published National Electrical Code to which there has been some objection in past years was the form in which the code was presented—it was difficult to find rules on some things and one could never be sure he had found all the rules governing any one matter. In the issue of the revised code, recently made available, the publishing committee has made some very commendable changes to increase the "usability" of the code. A better and more complete index is included. Paragraphing, titling and general arrangement of text are improved. These welcome changes will materially assist those who use it as a daily procedure.

In any discussion of the code and its present status there is one fact of which sight should not be lost. It was referred to in these pages in the April 7 issue, page 788, and again in the Sept. 22 issue, page 571. That is that steps should be taken to give the code, in its revised form, the status of an American standard through regular action of the A. E. S. C. As a matter of fact, once the code was made an American standard in its earlier form, better procedure would have been to have used A. E. S. C. machinery in the recent modifications.

The need for revision was insistent, however, and the time element involved in A. E. S. C. procedure, with no section then formed to consider it, would have delayed a revision for some months at least, so that it seemed best to the electrical committee that it should proceed on its own initiative with this revision, and it did so.

The situation now confronting the industry with reference to the code is this: The old code is an American standard; certain most necessary and advisable changes have been made by the electrical committee, the former responsible party; the revised code will be in a much stronger position, strategically, if made an American standard; the electrical committee can, with some modification, form an excellent nucleus of the A. E. S. C. section on the code; steps should be immediately taken to put the revised code through the necessary procedure to make it an American standard; and finally, no future code changes should be contemplated without first being sure that they will be made according to A. E. S. C. procedure.

It may not be at once apparent why so much insistence is placed on this line of argument. The reasons, however, are sufficient and are an outgrowth of long experience. First and foremost, the code is the property of no one group but belongs to the industry and affects every branch. The American Engineering Standards Committee was created to meet such conditions generally and to provide a mechanism which would assure a voice to every group legitimately interested in the formation of any particular standard. Such procedure produces best results and inspires greatest confidence. Second, greater moral strength is given to the code. As a result, the code is in a better strategical position to be used to the interests of the industry in its relations to the public if it is an American standard.

These comments are not made to point to past shortcomings. Rather are they directed to conditions as they are and to urging the electrical industry to see both its opportunity and its duty in its future handling

of the code situation. The A. E. S. C. itself cannot take the initiative—it must wait for the matter to be brought to its attention. Some organization in the industry should take formal action to bring the matter forcibly before the officials of the Standards Committee.

Supervisory Control and Remote Indication

AUTOMATIC operation of substations and small isolated generating stations seems quite definitely to be finding a logical and economical field of application. In connection with the operation of entire systems supervisory control and remote indication of position or condition of various apparatus will likewise find a definite field of application as pioneering in this line becomes more extensive and the results more widely known. Already several companies in the power field have adopted this relatively new system in full or in part, the most striking examples being installations made by the Malden (Mass.) Electric Company, the New York & Queens Electric Light & Power Company, the Interstate Public Service Company and the New York Edison Company. On the first three systems, where it is used to indicate the position of remotely situated switches as well as to control them, supervisory control has been in operation for various lengths of time. On the New York Edison system the supervisory indication feature has been used since 1913 to indicate at a central point the position of all of the generating station switches.

The various forms of supervisory control do not involve new and untried apparatus since they have been used in slightly different form for train dispatching, printing telegraph, telephone and similar purposes for several years. The question is how much inspection and maintenance will be required to assure reliability for the new application? The distributor type of supervisory control has given a very good account of itself on the Malden system, which had the distinction of being one of those able to restore service most quickly after the New England sleet storm of two years ago had created so much havoc. On the New York Edison network the original system was satisfactory except for maintenance, but this objection has been largely removed by incorporating newer types of apparatus. These changes, of course, improved the reliability of operation as well. Good reports have also been heard regarding the other systems, but sufficient details of experience have not been made available up to the present time.

So far it looks as if the logical field for combined remote control and indication were on average and small-sized systems, especially for substation work. Large companies recognize the advantages of remote indication, but some doubt whether the supervisory control feature as distinguished from remote indication can be utilized to advantage by them. For example, in case of trouble in a large generating station two operators have all they can do to take care of the situation, and, incidentally, the operators in generating stations tied to the one in trouble are extremely busy at the same time. Hence it would seem impracticable to control large systems from a central point. However, some engineers believe that it might be possible to control all substations from a central point, leaving generating stations to be controlled individually as at present. It has been pointed out that in an extensive system the large number of feeders involved would be analogous to the telephone boards in an exchange, and the possibilities of "wrong feeders" would be just as great in existing telephone systems.

It must not be inferred that any method of remote control could do away with the load dispatcher's board. It would be impossible to simulate a load dispatcher's board in a remote-control system by mimic buses, lines and so forth. The load dispatcher must have before him the complete system layout with reference to physical location. None the less, the supervisory indication should enable a load dispatcher to work with less likelihood of error than where the condition of switches must be reported by telephone.

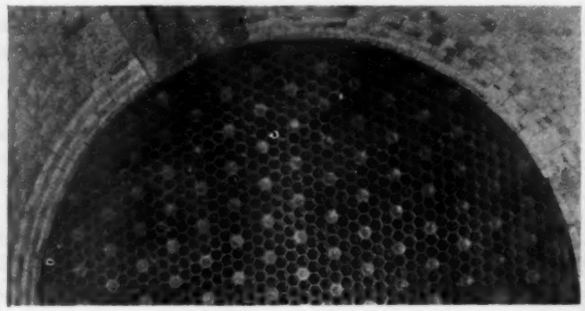
Despite the limitations which may be conjured up, supervisory control and indication have their logical and economical field of application. Before they can be definitely prescribed, however, more installations must be made and there must be frank discussion in order that any weaknesses which may be found shall be eliminated. Pioneers who are willing to make the trial are needed. Progress isn't made by companies which sit back and wait for the others to determine the practicability and reliability of new ideas.

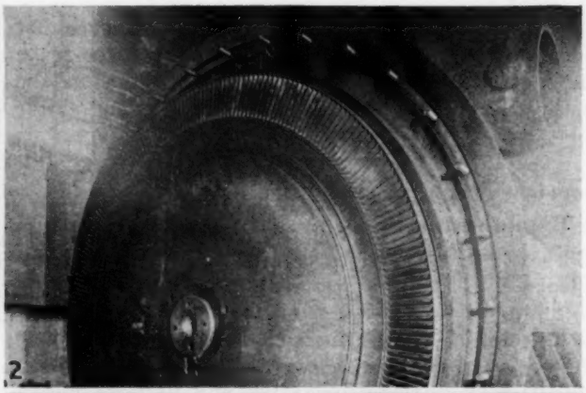
Expansion of Alternating-Current Distributing Networks

IT TAKES some brains and experience to run a single grocery store, but to operate successfully a chain of say one hundred identical grocery stores involves many more difficult problems unknown to a single establishment. In the same way a spread of distributing networks over large city areas, with several interconnected power plants, with numerous substations, and with customers whose individual demands run into hundreds and thousands of kilowatts, has called the attention of operating engineers to new and difficult problems. Moreover, these problems cannot wait until some future time "when we are not so busy," but must be handled rather promptly under the penalty of intolerable interruptions of the supply and heavy expenses for damaged apparatus.

The simplicity and the "abusability" of the large 220-volt direct-current underground distributing networks for a time perhaps closed the eyes of engineers and executives to quite different properties of the more recent alternating-current networks. Now, however, professional pride is at stake to make them just as dependable as direct-current networks. No engineer wants to admit to the general public that because of the additional link in the shape of transformers the furnished voltage must at times be equal to zero.

It is possible that some day an ingenious "jigger" will solve the problem of parallel operation of distributing transformers, of automatic disconnection of damaged alternating-current feeders at both ends, etc., but in the meanwhile every distribution engineer can study carefully each district of his network and apply partial remedies so as to reduce the probability of interruptions. In one case it may be a different spacing of the transformers, in another the use of much higher internal impedances, in still another the application of relay-operated switches. Since there is no general solution, if each engineer learns how to treat his own individual patients, the general problem will lose much of its acute importance and data will be obtained which will help in some future general plan.





Hartford's Pioneer Mercury Turbine

ORIGINALLY designed to deliver 1,800 kw. at the mercury turbo-generator and 28,000 lb. of steam per hour at 200 lb. pressure and 100 deg. superheat, yielding about 2,300 kw. in steam-generated energy, this pioneer turbine, carrying its first commercial load Sept. 7, 1923, has already delivered 3,500 kw. to the system, at the Dutch Point Station, 1,400 kw. of which was produced in the mercury turbine. Mercury vapor at about 35 lb. per square inch (above atmosphere) and 850 deg. F. drives this turbine. As the mercury condenses it imparts heat to generate steam, which is delivered to the steam main. Modern welding processes appear to have solved the problem of tight joints. About 7 lb. of mercury per kilowatt are required to charge the Hartford boiler, but future designing will undoubtedly reduce this by at least 50 per cent. Present results indicate a remarkably low fuel rate, perhaps only one-half the previous record at Dutch Point. The apparatus was built by the General Electric Company under the design and direction of W. L. R. Emmet.

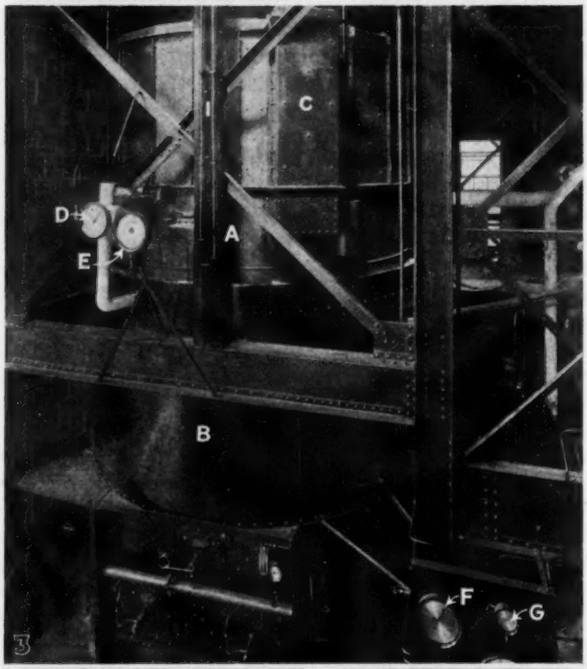
No. 1.—Bottom of mercury boiler from bottom of furnace, showing hexagonal cross-section of lower end of the tubes. The tubes are slightly conical and one in seven is omitted to permit circulation of the mercury.

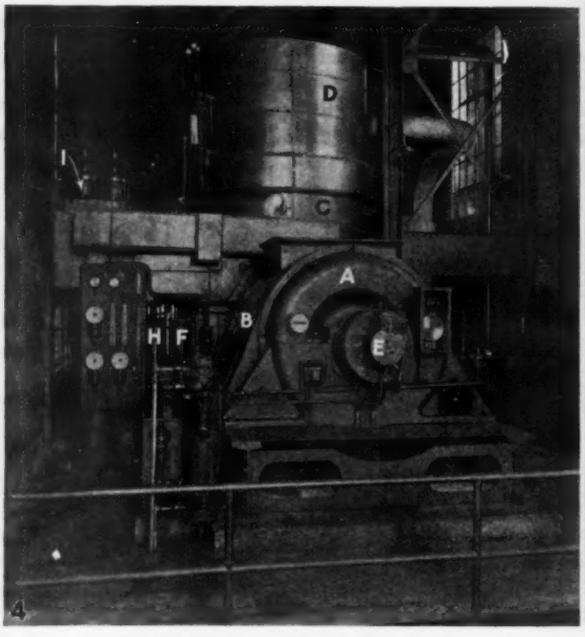
No. 2.—Blading of turbine runner.

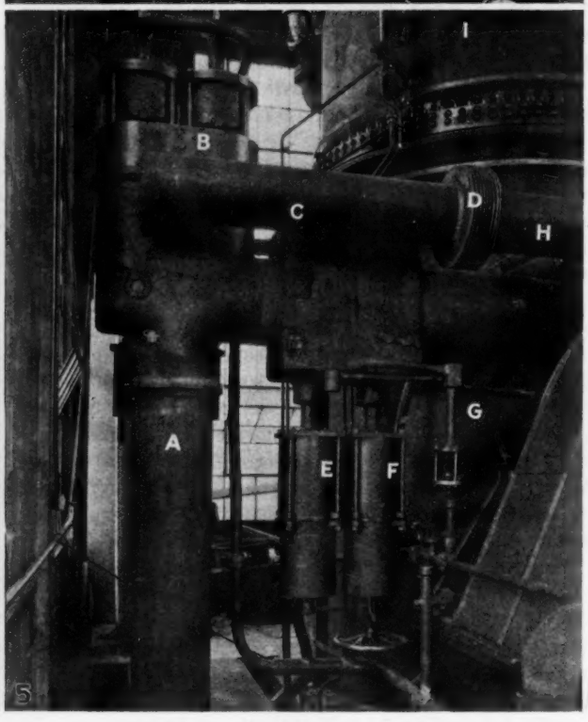
No. 3.—Mercury boiler. *A*, boiler; *B*, furnace casing; *C*, flue casing, inclosing vapor pipe; *D*, mercury-level gage; *E*, mercury-pressure gage; *F*, steam-pressure gage; *G*, vacuum gage; *H*, steam-flow meter; *I*, mercury columns for calibrating mercury gages.

No. 4.—Mercury turbo-generator set, condenser and condenser boiler. *A*, generator; *B*, turbine; *C*, mercury condenser; *D*, condenser steam boiler; *E*, flyball governor; *F*, electrically controlled governing valve and throttle; *G*, emergency air governor; *H*, electrically controlled emergency valve; *I*, mercury safety valve.

No. 5.—Safety, emergency and governing valves. *A*, Vapor pipe from boiler; *B*, safety valve; *C*, by-pass from safety valve direct into condenser; *D*, accordion expansion joint; *E*, electrically controlled emergency valve; *F*, electrically controlled governing valve; *G*, turbine; *H*, condenser; *I*, condenser steam boiler.







Steam Plant Auxiliaries

Discussion of Methods of Switching and Grouping Auxiliaries—Arrangements for Insuring Continuity of Service—Typical Installations—Choice of Voltage and House Service Supply

By C. D. GRAY and M. M. SAMUELS
The J. G. White Engineering Corporation

THE method of grouping and switching the various auxiliaries should be one of the most important considerations in the design of the electrical portion of a large steam plant of superpower proportions. Whereas the scheme of connections for the main circuits generally leaves very little choice, the main circuits being practically determined in each case by the particular operating method for bus through motor-generator balancer sets. In most cases all three, or at least two, of these sources of energy for house service are made available. Heat-balance problems will in each case determine the sizes and number of house turbines as well as the advisability of providing motor-generator balancer sets. The latest developments seem to indicate that the need for house turbines will gradually decrease by further development

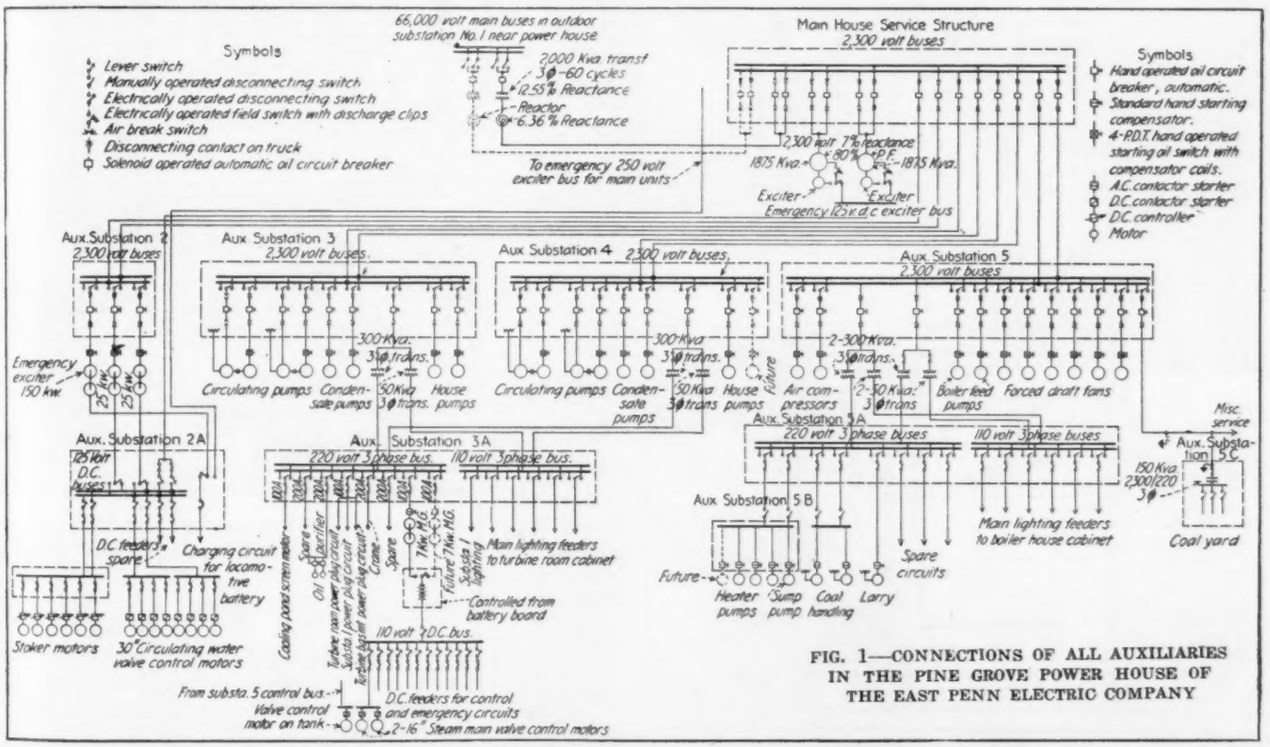


FIG. 1—CONNECTIONS OF ALL AUXILIARIES IN THE PINE GROVE POWER HOUSE OF THE EAST PENN ELECTRIC COMPANY

which the plant is designed, the number of possible schemes of grouping and connecting auxiliaries is almost unlimited. Even in outlying plants where the continuity of operation of the main units is not so important as in large city plants, it is very desirable to maintain almost absolute continuity on the auxiliary circuits, particularly those circuits supplying motors which drive boiler-house auxiliaries. A thorough study of the problem of auxiliaries leading to a systematic design of the auxiliary buses, switch groups, etc., is therefore of prime importance in the design of a large steam plant.

In virtually all large steam plants of recent design the auxiliaries are not supplied from the main buses nor controlled from the main control board. A separate house-service bus is generally established, controlled from a separate control switchboard, independent of the main board. Energy is furnished to the main house-service bus either from separate house turbines or from the main bus through transformers or from the main of means for "bleeding" the main units, but for the present the majority of large plants find it opportune to provide house turbines. Whether or not it is advisable to provide balancer sets is still an open question, and before deciding to use them a thorough investigation of the operating conditions should be made to determine if the benefits derived from balancer sets will not be more than offset by the additional complications which such sets must introduce in the switching and relay system. Even if it is found to be theoretically economical to provide balancer sets, the further question should be looked into as to whether or not the operators will in practice pay sufficient attention to these sets even to approach the theoretical economy.

The introduction of ties through transformers from the main bus to the house-service bus should also be handled with a great deal of care, and suitable switching and relay protection, and possibly reactors, should be provided to make sure that troubles on any of the lines supplied from the main buses will not interfere

with the operation of the auxiliary circuits. Therefore, even if it is found that house turbines are not required for heat-balance purposes, it will in most cases still be advisable to provide this independent source of energy for the house service and to provide switching on the tie transformer which will open in case of any trouble on the main bus or the main units before such trouble is continued onto the house bus.

Even in power houses having only one set of main buses, it is advisable to provide two sets of main house-service buses, only one of which is to operate at one time, the other being always available for inspection or repair. For the main house-service buses truck-type switches will be found the most convenient and most economical, the two sets of switches being arranged in two rows, each row having its bus self-contained in a steel housing, and an aisle provided between the two rows having a monorail over it, so that a truck can be moved out of its place and easily and quickly carried on the monorail to a suitable working space for repair.

The question of rupturing capacity of the main house-service breakers will generally be a difficult one to answer, for the same reason that the required rupturing capacity of the main breakers is very difficult to estimate, since it is not known to what capacity the power house may grow in the future. However, since it is absolutely necessary to plan for future extension, the best method is to make as reasonable an assumption as it is possible to make as to the ultimate capacity of the auxiliary bus, and then to arrange the system in such a way that when in the future the capacity of the bus grows beyond the rupturing capacity of the circuit breakers a new bus can be started. Thus, in the case of the Pine Grove power house of the East Penn Electric Company, which has a present installed main capacity of 33,500 kva. and an estimated ultimate capacity of 300,000 kva., it was considered expedient to limit the rupturing capacity of the breakers on the main house service to two house turbines, each rated at 1,875 kva., and two house transformers, each rated at 2,000 kva., the transformers being equipped with external reactance, making the total reactance of the transformer circuit 20 per cent. This will take care of the auxiliaries of a station having a total capacity of 150,000 kva. in main units, and when the station grows beyond this capacity a new main house-service bus will have to be started.

The voltage to be chosen is another very important consideration. Four hundred and forty volts seems to be in very general use for auxiliaries, which may have for its reason the fact that most operators grew up in small power houses having only a small number of auxiliary electrical drives. When a power house grows to superpower proportions, and with the modern tendency to make practically all auxiliaries electrically driven, the auxiliary load grows to thousands of kilowatts, and low-

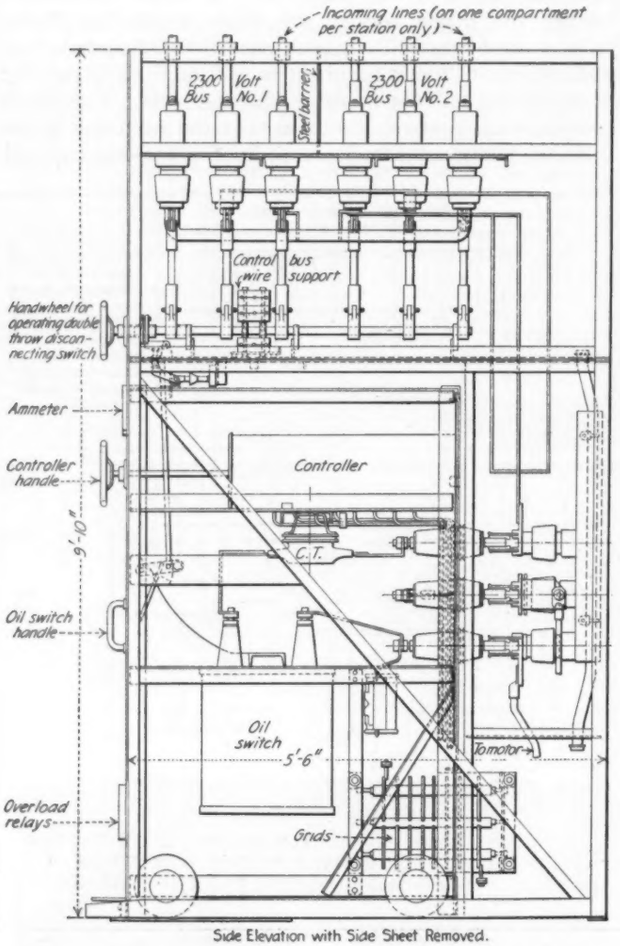


FIG. 2—TYPICAL STEEL COMPARTMENT CONTROLLING LARGE 2,300-VOLT SLIP-RING MOTOR FROM TWO SETS OF BUSES

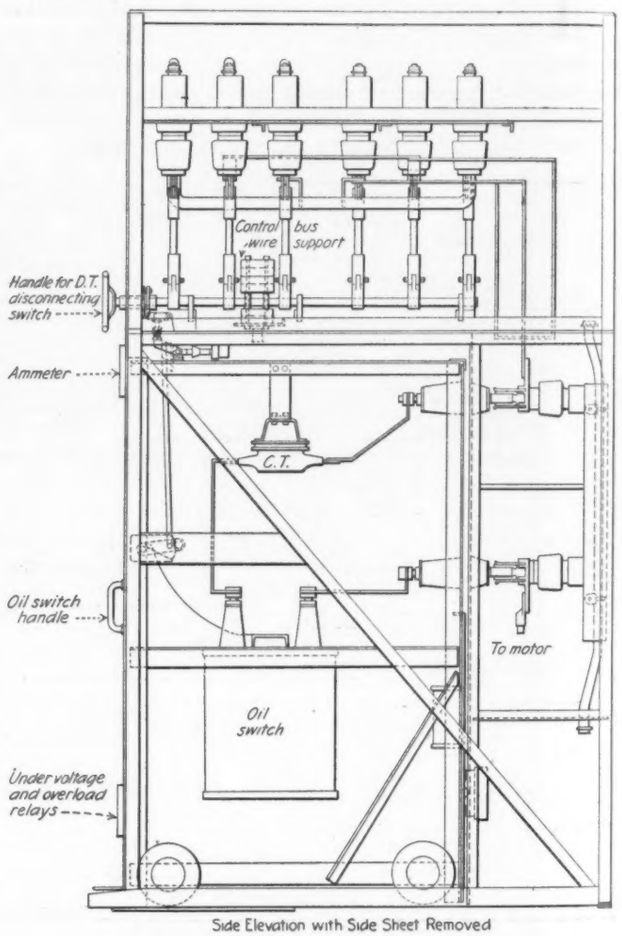
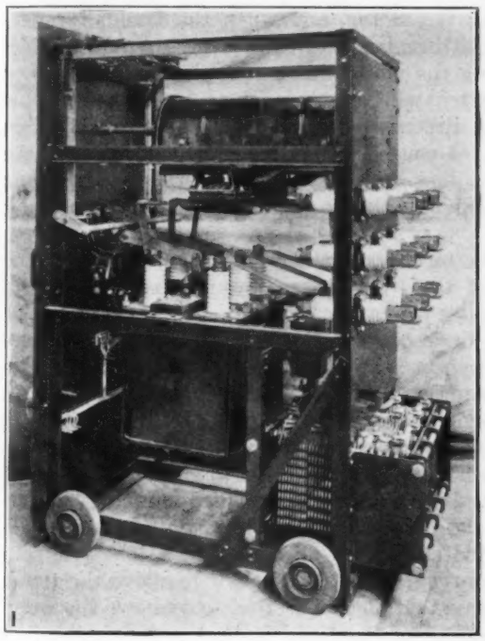
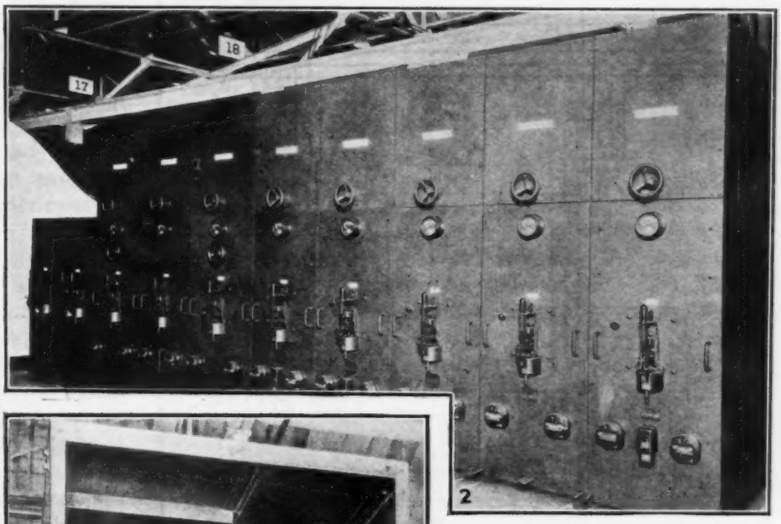
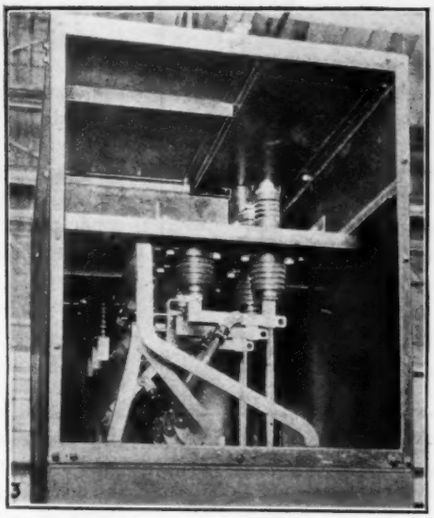


FIG. 3—TYPICAL STEEL COMPARTMENT CONTROLLING LARGE 2,300-VOLT SQUIRREL-CAGE MOTOR OR TRANSFORMER

voltage motors will require a great amount of very heavy conduit and cable, making the station extremely complicated and requiring, in addition, a great number of heavy-capacity circuit breakers and cumbersome heavy copper bus work. In most cases 440 volts is not so safe as either 2,300 volts or 220 volts. An operator will generally be careful with 2,300 volts to avoid accident, and 220 volts is not fatal; but, although 440 volts is almost as dangerous as 2,300 volts, operators will consider it low voltage and may be careless with it. The apparatus available for 2,300 volts is safer than that available for 440 volts and less expensive for the same kva. because of the low amperage. Statistics seem to indicate that the most balanced system, therefore, seems to be one using 2,300 volts on all large motors and 220 volts on smaller motors which are not built for 2,300 volts or where the cost of 2,300-volt starters would be too high.







AUXILIARY CONTROL APPARATUS OF THE PINE GROVE STATION

No. 1. Side view of the slip-ring motor-truck type switchboard. This switchboard contains the oil breaker, grids and controller for a slip-ring induction motor.

No. 2. Control board for auxiliary substation No. 3 (shown in detail in Fig. 1). This board is composed of truck-type compartments containing slip-ring controllers and disconnecting switches.

No. 3. The upper compartment is used to contain the double-throw disconnecting switches so that either auxiliary bus may be used. An interlock is provided, making it impossible to close the oil switch breaker when the disconnecting switch is open on both sides.

The choice of the types of motors to be used on the various auxiliaries is the next consideration of importance. Where constant-speed motors are required, the only question to be settled is one of slip ring versus squirrel cage, a question which will find its own answer in each individual case according to the starting conditions. In large plants it will generally not be necessary to use synchronous motors at all, and even in cases where it would seem offhand that they would offer some advantages, they will introduce complications in the switching and wiring and should therefore not be used unless absolutely necessary. Simplicity should be the most important feature in the design of all auxiliary installations.

Where variable-speed motors are required, as for fan or stoker drive, an attempt has been made recently, with more or less success, to use brush-shifting alternating-current motors. However, there are a number of serious objections to this type of motor which must be overcome before they can be considered very satisfactory for use on power-house auxiliaries. They are, first of all, very costly; they require a great amount of care in installation, and they call for a great number of delicate control and switching devices which are very difficult to install, take up altogether too much space and have to be continually looked after. The brush-shifting motor no doubt has great possibilities in the larger sizes, but before the above objections are overcome, even the very progressive engineer will prefer direct-current drive for variable-speed operation. A motor-generator of suitable capacity can be provided for the purpose, which, in cases where the voltage regulation is done on the main generator fields and the exciter voltage kept constant, can also be used as an emergency exciter. At the Pine Grove power house it was considered preferable to have constant-speed drives for the fans. The only variable-speed motors required, therefore, are those for the stokers, which are 125-volt direct-current, supplied from either of two 25-kw. motor-generators, each of which can likewise serve as an emergency exciter for the house turbines.

Each of the centrifugal pumps is directly connected to both a 200-hp. slip-ring motor and a 75-hp. squirrel-cage motor, the larger motor being used when it is necessary to operate the cooling-pond sprays and the smaller motor in cold weather when the sprays can be dispensed with.

The method of starting the various alternating-current motors is becoming more and more of a problem. In smaller power houses of the older type ordinary hand compensators with suitable overload and low-voltage protection were considered satisfactory, but the matter has recently been subjected to a careful study by the manufacturers and the conclusion reached by them that the usual type of standard starting compensator is not suitable for large power houses, even if it be used as a non-automatic starter and an automatic

oil circuit breaker installed in series with it. Manufacturers should be urged to design compensators suitable for heavy power-plant service, but until such compensators are available other means of starting auxiliary motors will have to be employed.

The tendency now is to develop motors which can be thrown on full voltage without starting apparatus. In some cases it is possible to do so now, and there are self-starting motors on the market, so it is hoped that in the near future it will be possible to eliminate all starting equipments for auxiliaries and merely provide an automatic oil switch for throwing the motor directly on full voltage, equipped with short-circuit and low-

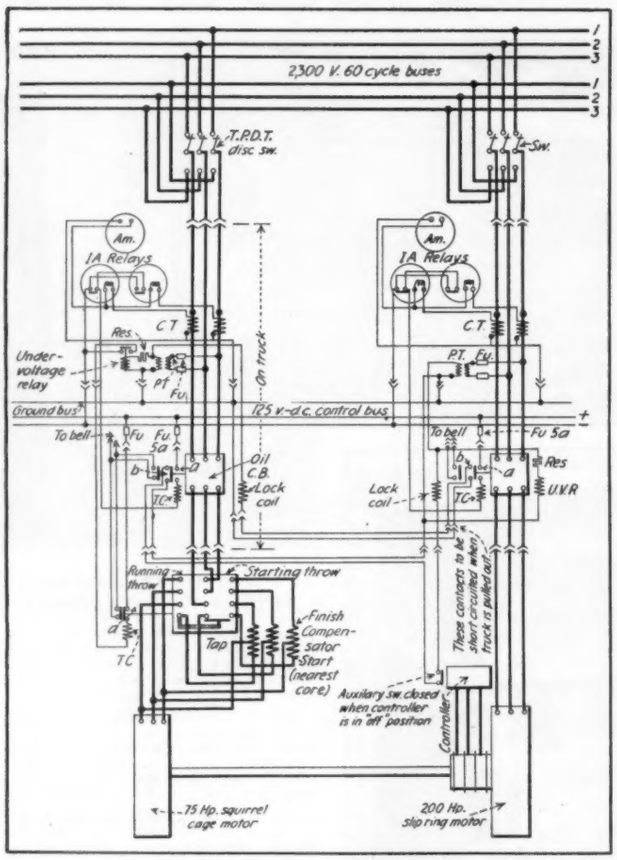


FIG. 4 — CONNECTIONS (IN FULL) FOR CONTROLLING ONE 200-HP. SLIP-RING MOTOR AND ONE 75-HP. SQUIRREL-CAGE MOTOR DRIVING THE SAME CIRCULATING PUMP

voltage protection, since ordinary overload protection is of very little importance in such cases.

In some large power plants a starting bus is provided by taking a 50 per cent tap out of the main house transformers or providing a starting transformer of two-to-one ratio supplied from the main house-service bus, supplying a main starting bus from which starting feeders are run to the various groups of motors in the same manner as the main feeders are run from the main house-service bus, and at each motor there is then provided a double-throw oil circuit breaker, non-automatic on the starting throw and automatic on the running throw. There are a number of objections to this scheme, the principal one being the necessity of providing four sets of buses and practically four throw switches at each motor, since two sets of running buses are a very desirable feature and two sets of starting transformers, with the resultant two sets of starting buses, would have to be provided, an arrangement which becomes very complicated. If only one set of running buses and one set of starting buses are satisfactory, the scheme shown in Fig. 5 is preferable where the starting bus is supplied from the running bus through an auto-transformer which is normally disconnected on both sides. A solenoid-operated single-throw non-automatic oil switch is provided on each side of the starting transformer, and a hand-operated double-throw oil switch is provided on each motor, non-automatic on the starting throw and automatic on the running throw, and equipped with auxiliary switches, so that when the manually operated oil switch on any motor is closed on the starting side the auxiliary switch will close the two solenoid-operated breakers of the starting transformer, thus starting the motor, and when the manually operated oil circuit breaker is thrown over to running side, thus throwing the motor on the running bus, the other auxiliary switch will trip the solenoid-operated circuit breakers and disconnect the starting transformer. This scheme has, of course, the same disadvantages as the previous one, and both have the further disadvantage of requiring double-throw switches of heavy rupturing capacity.

A much better arrangement is the one used on the auxiliaries of the Pine Grove power house. Here two sets of running buses are provided for each group of motors. A single-throw oil circuit breaker of the required rupturing capacity is provided for each large motor and equipped with a double-throw mechanically operated disconnecting switch. The oil circuit breaker is of the truck type, and the disconnecting-switch operating handwheel is mounted on a steel panel above the truck and an interlock provided, making it impossible to close the oil circuit breaker when the disconnecting switch is open on both sides. The two sets of buses are arranged in steel housings above the truck in such a way that it is possible to remove the steel covering of either of them and inspect or repair it without the possibility of accidental contact with the other bus, which may be operating. For slip-ring motors the controller and grids are arranged on the same truck with the oil circuit breaker, but for squirrel-cage motors a short feeder is provided from the oil circuit breaker to a small steel housing near the motor, which contains a non-automatic double-throw oil circuit breaker of low rupturing capacity, but of sufficient momentary carrying capacity, and an open-type core and coil compensator for starting purposes. No energized parts have to be exposed even for throwing over the disconnecting switches from one bus to the other.

ASSEMBLY OF EQUIPMENT

Perhaps the most important problem is to arrange and group the equipment in such a way as to provide the smallest amount of conduit and cable and so to centralize the equipment as to make it easily accessible for operation and supervision. The scattering of individual switches, starters, switch boxes and fuse boxes throughout the plant makes it almost impossible to supervise them properly and inspect them regularly.

The arrangement provided at Pine Grove proceeds logically along the lines followed for operating a customer's load. The basic idea of this system is to establish an "auxiliary substation" in a load center and to supply a group of motors from this substation, thus reducing the amount of cable to a minimum and making it possible to add motors on such an auxiliary substation

whenever required without going back to the main switching.

The majority of auxiliary substations at Pine Grove are 2,300-volt, and they in turn supply energy to the small transformers feeding 220-volt auxiliaries as well as to lighting transformers. To avoid the necessity of carrying long runs of heavy low-tension copper, the distribution system is made 2,300-volt and transformers are provided whenever low-tension energy is required. Thus separate 220-volt power transformers as well as separate lighting transformers are provided for the turbine room and for the boiler house. Each of these auxiliary transformers again supplies energy to a bus, likewise called an auxiliary substation. As may be seen from Fig. 1, on page 749, there are altogether four principal auxiliary substations and five subordinate auxiliary substations. Principal auxiliary substation 2 supplies the emergency motor exciters and is installed near the exciters on the main floor, together with subordinate auxiliary substation 2A, which takes care of the direct-current side of these motor-generators as well as the direct-current feeders. Each of the principal auxiliary substations 3 and 4 take care of a number of pumps belonging to a unit and are installed centrally near these pumps. When one of the units is shut down the respective auxiliary substation can likewise be de-energized. Each of these two substations feeds a 300-kva., 220-volt power transformer as well as a 50-kva. lighting transformer, each of which respectively supplies energy to one of the two sets of 220-volt power buses and to one of the two sets of the 110-volt, three-phase lighting buses, both 220-volt and 110-volt buses being for the turbine room only and with the respective switching making up the subordinate auxiliary substation 3A.

Principal auxiliary substation 5 is for boiler-house auxiliaries. It supplies 2,300 volts directly to all the 2,300-volt motors which are considered boiler-house auxiliaries, and through transformers supplies energy to subsidiary auxiliary substation 5A, 5B and 5C, which take care of the 220-volt boiler-house power loads and the 110-volt boiler-house lighting.

Not only is a minimum of cable required for this system, because of the elimination of practically all heavy low-tension runs, but it also allows for very easy supervision and facilitates the locating of any trouble which may arise. The panels of all the auxiliary substations are so numbered that the panel number at once identifies the substation to which it belongs. Thus, the panels belonging to auxiliary substation 2 are numbered 200, 201, etc., those belonging to substation 5 are numbered 500, 501, etc. It is for this reason that there is no auxiliary substation 1, since numbers 1 to 199 are used up for the main control boards and the house-service control board. The conduits running from any panel are marked with the respective panel number, so that if, for instance, a conduit marked 503-D is found any place in the power house, it is at once known that the cable in this conduit is controlled from panel No. 503 in auxiliary substation 5.

The question of space for auxiliary starting and switching equipment looms up very important in large power houses. In small plants where standard compensators are used this question can be virtually neglected in the general layout of the power house and in the determination of the required floor space, since compensators can readily be accommodated on walls or columns near the motors. In large power plants requiring

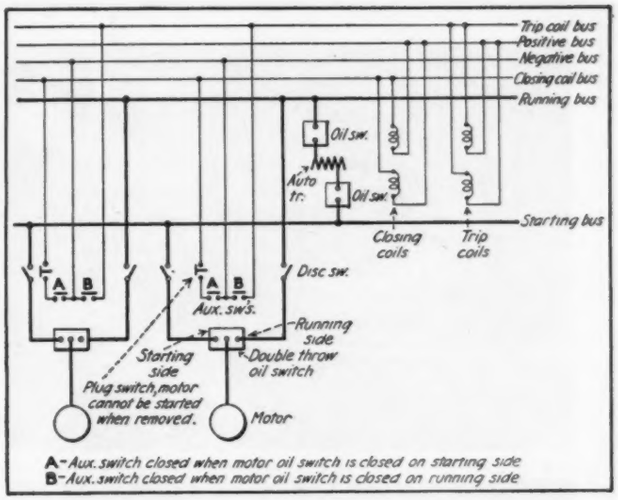


FIG. 5—CONNECTIONS FOR STARTING A GROUP OF MOTORS FROM SAME STARTING TRANSFORMERS

elaborate auxiliary switching, on the other hand, careful attention must be given to the space required for such equipment. Many of the existing large power plants have very unsystematic arrangements of auxiliary equipment, obviously caused by the fact that when the general arrangement of apparatus was determined upon insufficient attention was given to the question of how much space would be required for auxiliary equipment, and hence after the building construction was well under way it was necessary to place such equipment, not in the space in which it logically belonged, but in such free space as happened to be available.

Virtually all of the electric equipment for Pine Grove was furnished by the General Electric Company. The main house-service circuit breakers are solenoid-operated K-32-A, the main circuit breakers on the auxiliary substations are manually operated K-32-A, and the double-throw starting switches are K-5.

The Pine Grove power house, which is on the Swatara Creek at Pine Grove, Pa., was designed and constructed by the J. G. White Engineering Corporation.

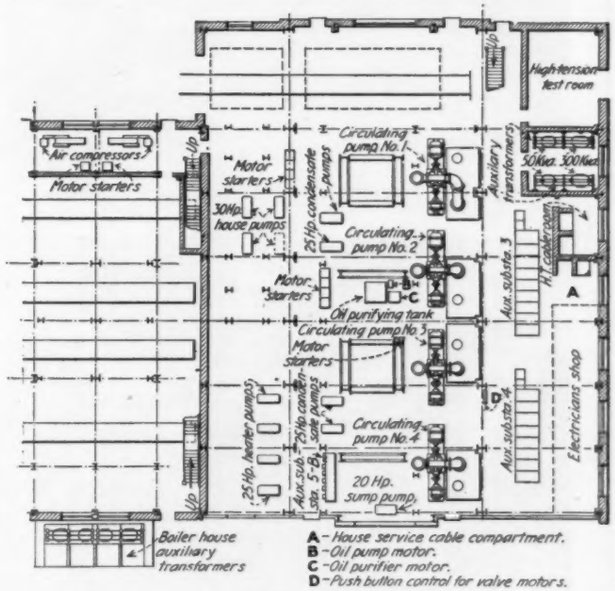
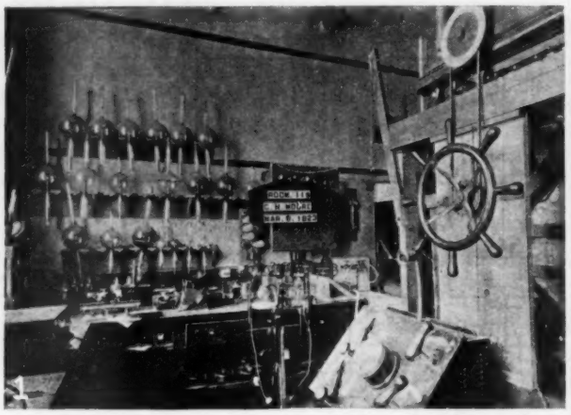
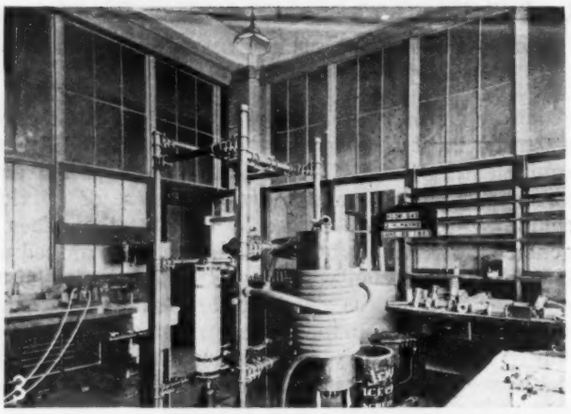
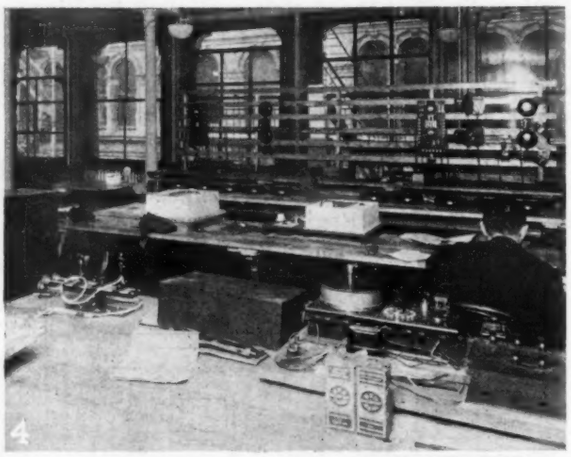
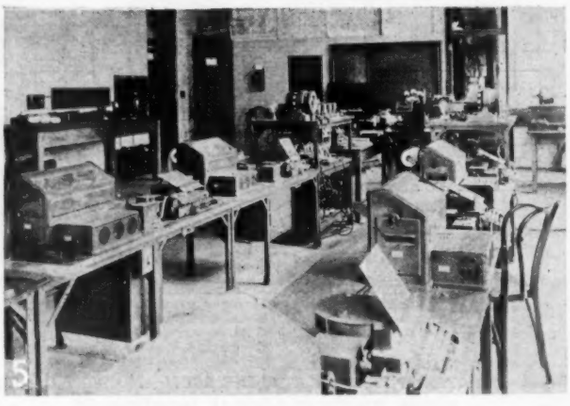


FIG. 6—BASEMENT PLAN OF TURBINE ROOM AND PART OF BOILER HOUSE, SHOWING LOGICAL LOCATION OF AUXILIARY SUBSTATIONS









Research Laboratories Aid Industry

AN IMPORTANT development of the last few years has been that of industrial research. For many years the colleges offered the only facilities for scientific research, but with the growth of the electrical industry there arrived a condition where industrial research laboratories became necessary to it. Most of these laboratories do both pure and applied research, and their work has resulted in many practical and theoretical developments. The growth of the research idea first developed by the electrical industry has extended to all the industries and is rapidly becoming recognized as a necessary adjunct to successful commercial operations.

Figs. 1, 2 and 3—Views of the Research Laboratory of the General Electric Company at Schenectady.

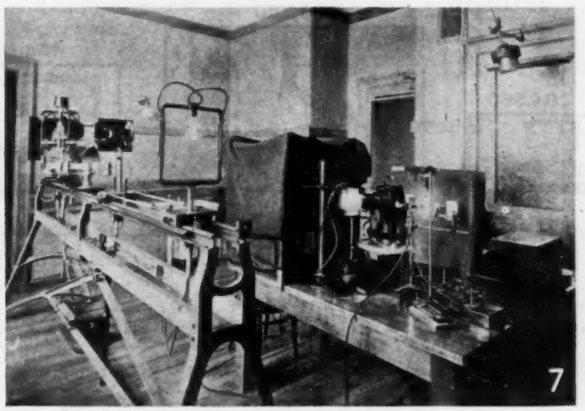
1. One of the rooms devoted to the developments of X-ray apparatus, including oil-immersed outfits and high-voltage tubes.

2. Special room devoted to the study of electrodynamics, showing equipment used in developing loud speakers, etc.

3. Room devoted to study of high-voltage vacuum tubes for power purposes; view of a 1,000-kw. tube.

Fig. 4.—Part of Underwriters' Laboratories in New York.

Most of the work of the electrical department of the laboratories is not exactly "research" work, although it all partakes more or less of that character. One work at present in progress is a special investigation of heater cord intended to develop especially appropriate methods of testing to show durability and service value of the different kinds of cords. Other subjects illustrating the work done are investigations of special hazard X-ray apparatus; studies of inclosed switches, construction and performance, and routine of special tests on cartridge-inclosed fuses, both the renewable and non-renewable types. Another important part of



the work is special investigations and tests on a large variety of fire-alarm signaling devices and systems, including automatic thermostats, manual systems and sprinkler supervisory systems. Aside from these there are the constant investigations of a wide variety of wiring devices both of standard and special forms, and also of domestic and industrial appliances of all service utilizing electricity for a wide range of purposes.

Fig. 5 — Communication Research Laboratory at Yale. Signal Corps officers of the army have done important researches in this laboratory. Many other universities have developed splendid research laboratories in their engineering departments.

Fig. 6—View of Western Electric Research Laboratories in New York. This laboratory has made many valuable research contributions to the art of communication. Dr. Clinton Davisson and Dr. C. H. Kunsman are seen inspecting their apparatus for studying the structure of atoms as revealed by the action of electrons.

Figs. 7 and 8—Views of the Nela Research Laboratory of the National Lamp Works.

7. Apparatus for the photometric and spectrophotometric study of lamps and new light sources.

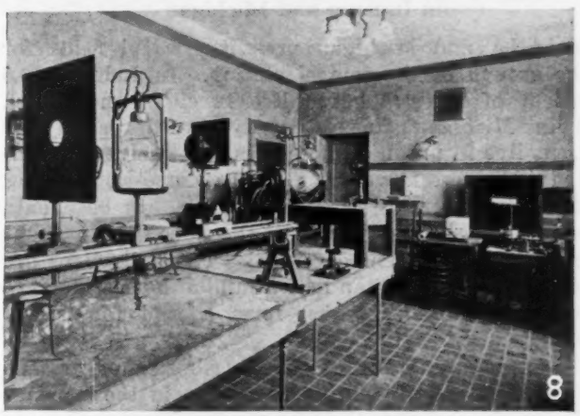
8. Apparatus for studying the emission from oxides heated to high temperatures.

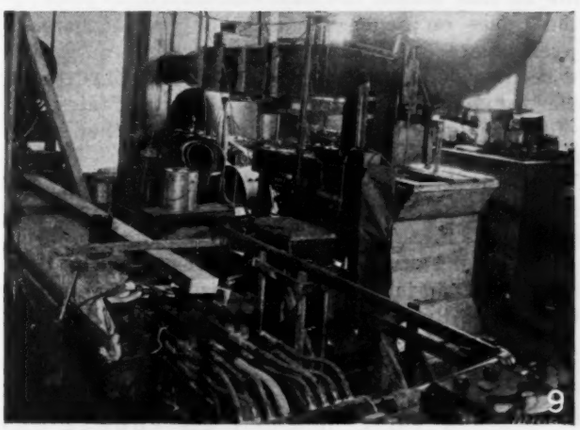
Figs. 9 and 10—Views of the research laboratory of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa.

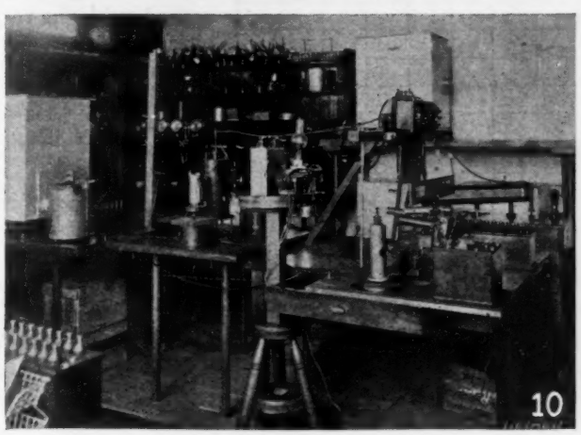
In addition to the tests depicted in the pictures, major researches now in progress include (1) magnetic material, (2) heat-conduction dissipation as applied to electrical machines, (3) radio researches, (4) ceramic researches, (5) metallurgical researches, (6) high-tension researches, (7) general researches on insulating materials, (8) physical properties of materials as applied to electrical machines, (9) transformer oil, and (10) electrochemical researches.

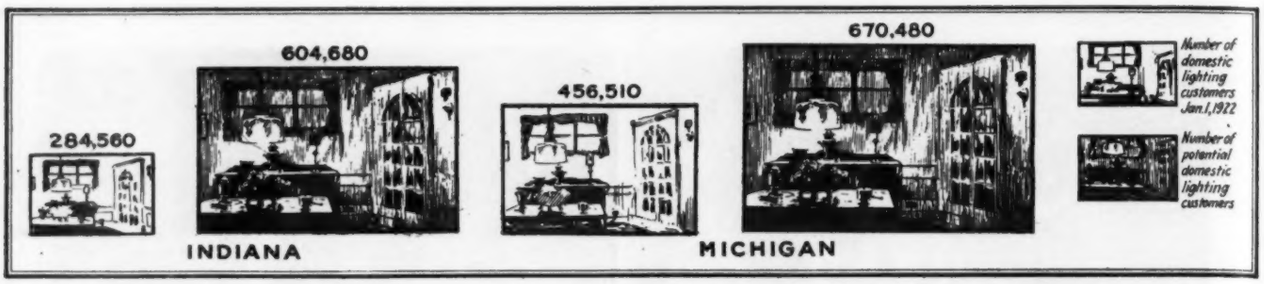
9. Durability of Insulation Tests. Left—Temperature tests on high-voltage generator insulations. Right —Dissipation of heat from high-voltage generator windings.

10. Durability of Insulation Tests. Front tables—Set-up for watt loss and power-factor determinations. Rear tables—Ovens and physical testing machines used in the study of effects of long-continued heating, under different conditions, on the life of various types of insulating materials.









THE DOMESTIC LIGHTING FIELD IN INDIANA AND MICHIGAN COMBINED IS ABOUT 58 PER CENT DEVELOPED

1,500,000 Potential Customers

"Electrical World" Estimate by Counties of Present and Possible Future Consumers of Electricity in Indiana and Michigan

INDIANA and Michigan present fruitful fields for the growth of the central station. In Indiana 56.5 per cent of the population live in cities and towns, and in Michigan almost exactly two-thirds of the citizens live in urban communities. A study just completed indicates, however, that the domestic lighting field of the central stations in Indiana has been only about 47 per cent developed and the same field in Michigan about 68 per cent developed. The indications are that there are more than half a million homes in these two states combined which form a field for future electrification.

Continuing its study of the distribution of present and potential central-station customers in the counties of the various states, the ELECTRICAL WORLD presents in the tables on pages 757 and 758 its estimate of the consumers in Indiana and Michigan. Studies have been made in previous issues of the ELECTRICAL WORLD for New England and the Atlantic States and also for Ohio and Illinois. Similar data for other states in the Union will appear in early issues.

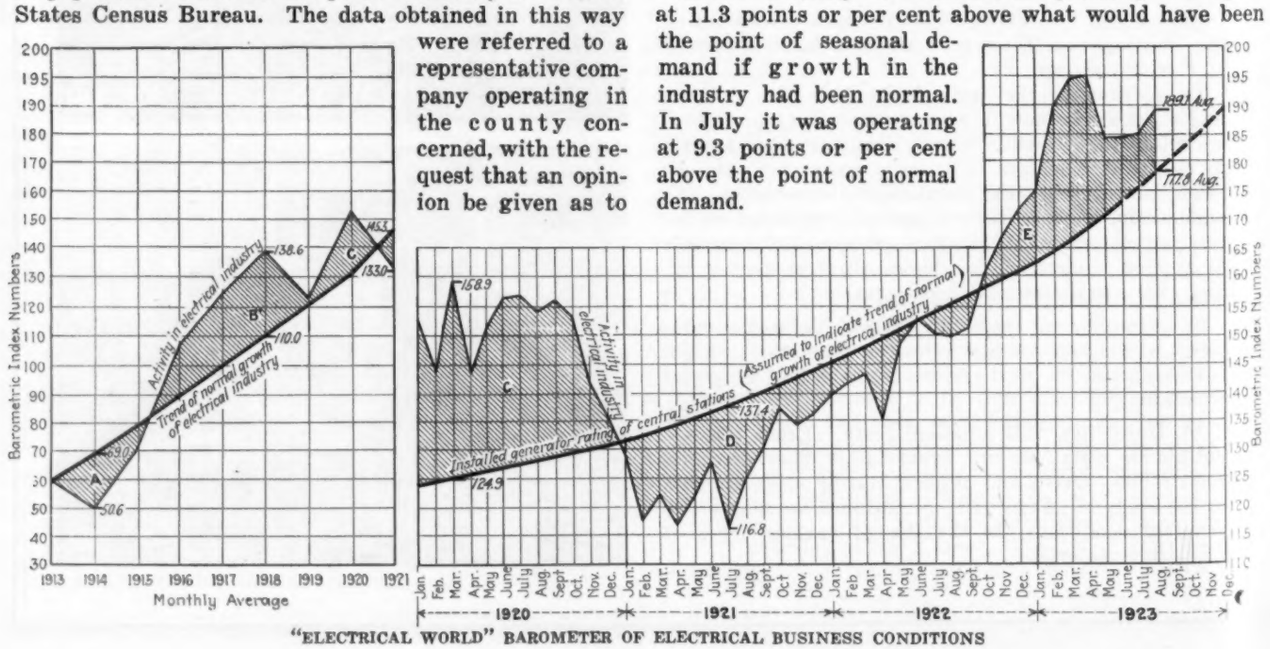
This study is based upon reports which have been received by the ELECTRICAL WORLD from operating companies representing about 70 per cent of the entire generator rating of the country, supplemented by data on population and industrial power issued by the United States Census Bureau. The data obtained in this way were referred to a representative company operating in the county concerned, with the request that an opinion be given as to whether they represented with a fair degree of accuracy conditions existent in that county.

In the few cases where the operating companies to which the figures were sent indicated that the ELECTRICAL WORLD figures were at variance with conditions in the county a new study was made, and the data were corrected accordingly. The figures for the various counties, although estimates, are believed to indicate very clearly the present and future potentialities of these counties as ultimate purchasers of electrical apparatus, appliances and supplies.

Increased Activity Indicated During August

INDEX figures upon which the "ELECTRICAL WORLD Barometer of Business Conditions in the Electrical Industry" is based indicate that activities within the industry took an upward turn during August. Some of the basic industries, such as pig-iron production, reported decreased operations, but other industries entering into the ELECTRICAL WORLD'S index of activity in the electrical industry increased their operations above those of July.

The basic data upon which the "ELECTRICAL WORLD Barometer" is based indicate an increase of four points on the barometer scale, as compared with July activities. During this interval the industry has grown two points, leaving a net increase in activity of two points on the barometer scale as compared with July. The electrical industry as a whole was operating in August at 11.3 points or per cent above what would have been the point of seasonal demand if growth in the industry had been normal. In July it was operating at 9.3 points or per cent above the point of normal demand.


Barometric Index Numbers
Activity in electrical industry
Trend of normal growth of electrical industry
Monthly Average
1913 1914 1915 1916 1917 1918 1919 1920 1921
Activity in electrical industry
Installed generator rating of central stations
(Assumed to indicate trend of normal growth of electrical industry)
1920 1921 1922 1923

"ELECTRICAL WORLD" BAROMETER OF ELECTRICAL BUSINESS CONDITIONS

Present and Potential Central-Station Customers in Indiana by Counties

State and County	Population (Census of 1920)			Domestic Lighting Customers		Commercial Lighting Customers		Industrial Power Customers	
	Total	Urban*	Rural	Total (Jan. 1, 1922)	Total Potential (Including Present Customers)	Total (Jan. 1, 1922)	Total Potential (Including Present Customers)	Total (Jan. 1, 1922)	Total Potential (Including Present Customers)
INDIANA	2,930,390	1,654,750	1,275,640	284,560	604,680	46,160	99,670	14,900	35,900
Adams	20,503	6,299	14,204	1,130	3,330	200	590	50	250
Allen	114,303	87,786	26,517	10,030	24,050	2,180	5,230	1,330	1,800
Bartholomew	23,887	10,173	13,714	1,580	4,560	240	690	40	200
Benton	12,206	1,442	10,762	690	2,070	180	540	10	70
Blackford	14,084	8,480	5,604	1,140	2,910	210	540	20	100
Boone	23,575	7,689	15,886	1,520	4,460	230	680	50	230
Brown	7,019	0	7,019	180	820	10	50	10	30
Carroll	16,315	3,528	12,787	1,030	3,090	150	450	30	130
Cass	38,333	21,626	16,707	3,060	7,850	640	1,640	310	470
Clark	29,381	12,420	16,961	1,780	4,990	310	870	120	280
Clay	29,447	12,519	16,928	2,000	5,520	350	970	50	230
Clinton	27,737	11,585	16,152	2,130	5,720	440	1,180	250	300
Crawford	11,201	0	11,201	420	1,560	50	190	20	100
Daviess	26,856	8,743	18,113	1,530	4,460	270	790	50	260
De Kalb	25,600	12,363	13,237	1,930	5,250	320	870	40	190
Dearborn	20,033	7,765	12,268	1,700	3,540	190	560	40	190
Decatur	17,813	5,345	12,468	1,070	3,290	150	460	40	190
Delaware	56,377	39,071	17,306	1,000	17,000	1,200	1,500	680	910
Dubois	19,915	5,800	14,115	940	2,910	160	500	60	290
Elkhart	56,384	48,480	7,904	6,140	14,160	1,230	2,840	560	1,360
Fayette	17,142	9,901	7,241	2,680	4,000	400	500	110	150
Floyd	30,661	22,992	7,669	2,840	6,940	550	1,340	130	520
Fountain	18,823	4,972	13,851	1,140	3,440	160	480	40	190
Franklin	14,806	2,220	12,586	660	2,270	80	280	40	190
Fulton	16,478	3,720	12,758	990	2,990	140	420	50	230
Gibson	29,201	11,980	17,221	1,810	5,190	300	860	50	230
Grant	51,353	31,502	19,851	7,530	11,470	1,370	2,100	410	830
Greene	36,770	14,042	22,728	2,320	6,570	400	1,130	40	190
Hamilton	24,222	7,579	16,643	1,670	4,790	250	720	40	190
Hancock	17,210	5,381	11,829	1,300	3,640	200	560	30	130
Harrison	18,656	1,785	16,871	600	2,450	40	70	30	50
Hendricks	20,291	4,165	16,126	1,120	3,510	160	500	30	130
Henry	34,682	17,649	17,033	2,660	7,070	460	1,220	80	440
Howard	43,965	31,230	12,735	3,920	9,620	770	1,890	160	750
Huntington	31,671	16,591	15,080	5,000	6,490	800	1,140	260	460
Jackson	24,228	10,033	14,195	1,500	4,320	250	720	50	230
Jasper	13,961	3,956	10,005	690	2,180	100	310	10	70
Jay	23,318	9,723	13,595	1,680	4,690	270	750	40	190
Jefferson	20,709	6,711	13,998	1,400	3,600	350	600	110	200
Jennings	13,280	3,084	10,196	650	2,140	80	260	20	100
Johnson	20,739	9,192	11,547	1,470	4,110	240	670	30	160
Knox	46,195	25,845	20,350	6,280	8,810	1,250	1,750	280	830
Kosciusko	27,120	7,667	19,453	2,200	5,100	300	770	100	320
La Porte	50,443	34,615	15,828	4,280	10,520	880	2,160	240	710
Lagrange	14,009	1,610	12,399	770	2,430	100	320	10	70
Lake	159,957	153,871	6,086	14,940	33,720	3,730	8,420	310	1,380
Lawrence	28,228	12,101	16,127	1,810	5,110	310	880	40	190
Madison	69,151	48,053	21,098	6,170	15,220	1,190	2,940	350	1,170
Marion	348,061	318,363	29,698	58,410	85,750	6,960	10,210	3,600	6,250
Marshall	23,744	9,872	13,872	2,290	4,630	350	750	70	230
Martin	11,865	3,367	8,498	530	2,120	80	320	20	100
Miami	28,668	13,459	15,209	2,500	5,920	380	1,010	170	360
Monroe	24,519	11,595	12,924	1,680	4,630	290	800	100	310
Montgomery	28,490	11,149	17,341	2,220	5,980	370	1,000	220	530
Morgan	20,010	6,676	13,334	1,220	3,640	180	540	30	160
Newton	10,144	3,467	6,677	640	1,840	110	320	10	70
Noble	22,470	8,452	14,018	1,560	4,410	240	680	40	190
Ohio	4,024	1,411	2,613	250	750	10	20	10	30
Orange	16,974	4,908	12,066	850	2,730	120	390	30	130
Owen	12,760	2,066	10,694	610	2,040	70	230	20	100
Parke	18,875	3,146	15,729	860	2,970	100	350	30	130
Perry	16,692	6,094	10,594	890	2,640	160	480	30	160
Pike	18,684	3,507	15,177	1,150	2,700	180	290	30	70
Porter	20,256	8,122	12,134	1,270	3,650	210	580	30	160
Posey	19,334	6,410	12,924	1,200	3,470	200	580	30	130
Pulaski	12,385	1,684	10,701	570	1,890	80	270	10	70
Putnam	19,880	3,780	16,100	2,900	3,460	190	450	40	130
Randolph	26,484	8,469	18,015	1,400	5,210	270	1,010	50	230
Ripley	18,694	3,454	15,240	1,350	3,600	110	370	50	400
Rush	19,241	5,498	13,743	1,200	3,610	170	510	30	130
St. Joseph	103,304	87,209	16,095	20,920	33,950	3,290	4,840	810	1,210
Scott	7,424	1,609	5,815	430	1,150	70	140	10	70
Shelby	25,982	9,701	16,281	1,610	4,820	230	680	100	180
Spencer	18,400	2,581	15,819	820	2,770	110	370	30	130
Starke	10,278	2,766	7,512	550	1,710	80	250	10	30
Steuben	13,360	2,650	10,710	880	2,650	110	330	30	160
Sullivan	31,630	10,722	20,908	1,700	5,250	260	800	30	130
Switzerland	9,311	1,175	8,136	360	1,420	30	120	10	30
Tippecanoe	42,813	26,316	16,497	4,700	4,700	670	670	210	210
Tipton	16,152	4,506	11,646	1,060	3,010	170	480	30	130
Union	6,021	1,292	4,729	310	1,060	30	100	20	100
Vanderburg	92,293	86,688	5,605	9,000	20,000	2,500	4,500	750	1,500
Vermilion	27,625	13,833	13,792	1,760	4,630	340	900	70	220
Vigo	100,212	70,393	29,819	10,000	21,320	1,550	4,250	470	1,560
Wabash	27,231	12,583	14,648	2,070	5,600	350	950	50	260
Warren	9,699	1,088	8,611	440	1,560	50	180	10	30
Warrick	19,862	5,746	14,116	1,300	3,150	200	450	40	130
Washington	16,645	2,836	13,809	720	2,520	80	280	20	100
Wayne	48,136	29,966	18,170	4,210	10,590	770	1,940	570	1,320
Wells	20,509	5,391	15,118	1,150	3,540	170	520	30	190
White	17,351	3,893	13,458	1,140	3,230	180	510	30	130
Whitley	15,660	3,573	12,087	1,300	4,480	250	350	70	130

*Cities and towns of over 1,000 population.

Present and Potential Central-Station Customers in Michigan by Counties

State and County	Population (Census of 1920)			Domestic Lighting Customers		Commercial Lighting Customers		Industrial Power Customers	
	Total	Urban*	Rural	Total (Jan. 1, 1922)	Total Potential (Including Present Customers)	Total (Jan. 1, 1922)	Total Potential (Including Present Customers)	Total (Jan. 1, 1922)	Total Potential (Including Present Customers)
MICHIGAN	3,668,412	2,445,226	1,223,186	456,510	670,480	78,015	115,749	18,246	29,260
Alcona	5,912	0	5,912	110	410	10	40	10	30
Alger	9,983	5,037	4,946	470	1,110	120	280	10	30
Allegan	37,540	8,854	28,686	1,780	4,740	240	640	30	140
Alpena	17,869	11,101	6,768	1,800	3,800	270	300	20	40
Antrim	11,543	1,214	10,329	590	1,510	90	230	10	30
Arenac	9,460	0	9,460	190	680	20	70	10	30
Baraga	7,662	1,013	6,649	230	620	40	110	10	50
Barry	21,383	6,508	14,875	1,230	3,130	160	410	20	80
Bay	69,548	49,092	20,456	11,000	15,000	1,060	1,500	180	430
Benzie	6,947	1,244	5,703	430	1,060	70	170	10	30
Berrien	62,653	32,417	30,236	4,930	11,390	770	1,780	290	490
Branch	23,997	9,880	14,117	3,200	3,890	200	300	150	200
Calhoun	72,918	49,864	23,054	8,600	14,770	1,450	2,280	460	880
Cass	20,395	6,825	13,570	1,290	3,180	180	440	10	50
Charlevoix	15,788	8,930	6,858	1,850	2,540	340	470	24	50
Cheboygan	13,991	5,642	8,349	1,200	2,150	250	500	50	150
Chippewa	24,818	12,096	12,722	2,720	3,000	500	600	170	200
Clare	8,250	1,462	6,788	210	880	40	170	10	30
Clinton	23,110	4,992	18,118	970	2,700	120	330	10	50
Crawford	4,049	2,450	1,599	400	680	50	90	10	30
Delta	30,909	19,605	11,304	3,900	4,780	620	750	110	160
Dickinson	19,456	15,030	4,426	1,560	3,410	330	720	10	50
Eaton	29,377	11,583	17,794	2,200	4,500	500	650	50	70
Emmet	15,639	6,664	8,975	1,900	2,560	190	440	60	100
Genesee	125,668	97,705	27,963	20,000	28,000	2,800	5,000	400	500
Gladwin	8,827	1,225	7,602	260	400	100	120	10	20
Gogebic	33,225	25,372	7,853	2,350	5,160	550	1,200	40	150
Grand Traverse	19,518	10,985	8,533	2,300	3,300	500	700	210	350
Gratiot	33,914	12,507	21,407	1,870	4,700	280	710	20	80
Hillsdale	28,161	7,786	20,375	1,640	4,200	210	540	20	80
Houghton	71,930	54,673	17,257	5,480	12,050	1,170	2,570	30	160
Huron	32,786	5,513	27,273	1,040	3,020	150	440	10	50
Ingham	81,554	63,244	18,310	7,920	17,300	1,370	2,990	750	970
Ionia	33,087	13,991	19,096	2,240	5,380	330	890	20	110
Iosco	8,199	3,538	4,661	520	1,240	90	210	10	30
Iron	22,107	11,165	10,942	1,220	2,840	250	580	20	80
Isabella	22,610	4,819	17,781	850	2,360	120	330	10	50
Jackson	72,539	48,374	24,165	6,500	14,470	1,090	2,420	870	980
Kalamazoo	71,225	50,199	21,026	6,650	14,880	1,100	2,460	240	800
Kalkaska	5,577	0	5,577	240	650	90	125	12	30
Kent	183,041	143,029	40,012	17,430	37,100	3,050	6,480	1,100	3,010
Keweenau	6,322	2,351	3,971	320	770	70	170	10	30
Lake	4,437	0	4,437	60	300	10	50	10	50
Lapeer	25,782	5,934	19,848	1,310	3,340	200	510	10	50
Leelanau	9,061	0	9,061	270	800	40	120	10	30
Lenawee	47,767	20,377	27,390	5,760	8,190	1,020	1,170	170	250
Livingston	17,522	4,008	13,514	2,930	3,500	830	1,200	130	200
Luce	6,149	2,172	3,977	200	510	50	130	10	30
Mackinac	8,026	1,852	6,174	310	830	50	134	10	30
Macomb	38,103	12,893	25,210	5,910	7,000	1,200	1,400	320	400
Manistee	20,899	9,694	11,205	1,360	3,220	230	550	20	80
Marquette	45,786	32,665	13,121	4,800	7,470	970	1,510	220	390
Mason	19,831	9,855	9,976	3,000	4,000	350	500	130	150
Mecosta	17,765	4,558	13,207	860	2,270	120	320	10	50
Menominee	23,778	11,464	12,314	1,340	3,140	270	630	20	80
Midland	17,237	5,483	11,754	830	2,130	130	330	10	30
Missaukee	9,004	0	9,004	160	630	10	40	10	30
Monroe	37,115	12,681	24,434	4,500	4,900	800	950	110	290
Montcalm	30,441	4,304	26,137	1,500	4,000	200	530	20	80
Montmorency	4,089	0	4,089	80	290	10	40	10	30
Muskegon	62,362	47,314	15,048	5,770	12,640	1,030	2,260	660	910
Newaygo	17,328	3,340	14,038	700	1,940	90	250	10	50
Oakland	90,050	53,807	36,243	11,990	15,540	1,320	1,700	500	580
Oceana	15,601	2,878	12,723	850	2,120	130	320	10	50
Ogemaw	7,786	1,105	6,681	250	750	30	90	10	30
Ontonagon	12,428	1,406	11,022	220	760	30	100	10	30
Osceola	15,221	3,129	12,092	520	1,530	70	210	10	30
Oscoda	1,783	0	1,783	20	100	10	20	0	10
Otsego	6,043	1,701	4,342	260	670	40	100	10	30
Ottawa	47,660	23,663	23,997	3,170	7,430	540	1,270	190	530
Presque Isle	12,131	4,898	7,233	540	1,340	100	250	10	30
Roscommon	2,032	0	2,032	60	190	10	30	0	10
Saginaw	100,286	70,759	29,527	8,610	19,020	1,540	3,410	540	950
St. Clair	58,009	35,405	22,604	8,430	10,540	1,565	1,950	300	490
St. Joseph	26,818	12,481	14,337	2,310	5,300	340	780	20	110
Sanilac	31,237	1,678	29,559	860	2,730	100	320	10	50
Schoolcraft	9,977	6,380	3,597	900	1,520	200	340	50	70
Shiawassee	35,924	16,818	19,106	3,820	5,270	760	960	170	330
Tuscola	33,320	5,385	27,935	1,280	3,580	210	590	10	50
Van Buren	30,715	10,332	20,383	1,750	4,500	230	590	30	140
Washtenaw	49,520	31,106	18,414	9,630	11,000	1,810	2,100	490	600
Wayne	1,177,645	1,135,972	41,673	226,000	252,040	40,000	46,000	8,400	10,900
Wexford	18,207	9,750	8,457	1,800	3,140	440	790	80	150

* Cities and towns of over 1,000 population.

Regulation of High-Voltage Lines

Typical Cases Involving the Action of Different Types of Regulators Are Discussed to Indicate Factors in Handling the Problem of Voltage, Power Factor and Load Regulation

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WHEN investigating the advisability of providing regulation on high-voltage lines, due attention must be given to the connection and use of such lines as well as to the selection of the proper type of regulator and its location. Among the line arrangements which must be considered are: (1) A single line used as a feeder only; (2) two feeder lines supplied from a common bus and also connected together at some point beyond the bus, constituting a parallel connection or a loop system; (3) a single line connecting two or more generating stations, and (4) two or more parallel lines connecting two generating stations. Of the various means for obtaining regulation there are the induction regulator (both single-phase and polyphase), the series synchronous booster, a transformer with taps and dial switches, a combination of a transformer with taps and dial switches and an induction regulator, and the synchronous condenser. The object of a regulator may be to compensate for the voltage drop in a line, to control the power factor of the load delivered to a distributing or power system by one or more of several generating stations, or to control the load carried by two or more parallel connected lines.*

In handling the problem of regulation certain elementary theory must be clearly kept in mind. For example, the voltage drop in a line is due to the ohmic and the reactance of the line. The voltage drop due to the former is in phase with and that due to the latter at right angles to the current. Therefore the angular phase displacement of the voltage drop to the generator voltage at any point on the line depends on the relation of the resistance of the line to its reactance, and it is further modified by the angular relation of the line current to the line voltage, i.e., by the power factor of the load.

The phase displacement of the line voltage drop with respect to the generator voltage has no particular significance when considering a single line, but it must be taken into account if two or more lines are operated in parallel. Two parallel lines of unlike characteristics or carrying loads of different power factors are analogous to two parallel-operated, unequally loaded and unequally excited generators. The generator which is leading in phase supplies a greater amount of power to the line and the higher-excited generator supplies a leading wattless current to the lower-excited one until the voltages at their terminals are equal.

Since the voltage drop in a line due to resistance is in phase with the line current, an unequal drop in two parallel lines, before the lines are connected in parallel, would cause a wattless current to flow from the higher-voltage line to the lower-voltage one when the connection is made, this current being of such a value as to equalize the voltages. In like manner, the reactance voltage drop being at right angles to the current flow, an unequal resistance of the two lines corresponds to a phase displacement of the two parallel generators considered and causes a power current to flow from the line the voltage of which is in advance to the other line. In other words, the distribution of a load over parallel lines depends on the constants of the lines, on the nature of the load and on the location of the load along the lines.

SIGNIFICANCE OF PHASE DISPLACEMENT BY REGULATORS

The induced voltage of a transformer with taps combined with a voltage-regulating switch, as well as that of a single-phase induction regulator, is practically in phase with the line voltage, whereas the voltage of a synchronous motor-generator or that of a polyphase regulator may be out of phase. This out-of-phase voltage corresponds to the phase displacement of parallel-connected alternators when such regulators are used in parallel lines. The phase displacement in the motor-generator set is due to the armature reactance of both motor and generator and also to the lag of the motor under load, whereas that introduced by the polyphase regulator is due to the mechanical displacement of the primary and secondary windings as the armature is rotated.

In considering the voltage regulation of a single line, any phase displacement which may be introduced by the regulator has no more significance than the phase displacement caused by the line voltage drop except that with the synchronous booster a compensation must be provided for the phase displacement of its own voltage under load either by a sufficient over-ratio or by a phase adjustment. Any design or type of regulator may therefore be used.

The employment of a regulator on a single line used as a feeder only is for the control of the voltage of the line, whereas if the line is used as an interconnection between two generating stations, the object of the regulator is to control the power factor of one of the generating stations and influence the load carried by the line. In the latter case any phase shift which may be introduced by the line voltage drop or by the regulator is compensated for by a corresponding phase shift of the connected generators, so that each generator will deliver its proportion of the load as determined by the adjustments of the governors of the prime movers. Therefore, for the case considered, the adjustment of any type of regulator results eventually only in a change in the value of the voltage and hence controls only the wattless current flowing in the line.

The interconnection of more than two generating stations may be by means of a single line, as for example, a T-connection of three generating stations, or by means of a loop or ring bus.

The first arrangement is similar to the interconnection of two generating stations by means of a single line,

*For a more detailed and comprehensive discussion of this subject the reader is referred to the author's handbook entitled "The Induction Voltage Regulator," recently published by the General Electric Company.

whereas the second constitutes a parallel line connection between the generating stations in that the current flow from any station may be through either side of the loop. However, in either case the control of the power factor of the load delivered to the interconnected system by each of the generating stations requires the voltage control of the individual feeders supplying the system.

The voltage adjustment for the control of power factor may be beneficial or detrimental to the voltage regulation requirements of the line, depending on the location of the regulator, the distribution of the load and the direction of the flow of power.

RELATIVE MERITS OF REGULATORS

From the preceding comments it is apparent that the most economical operation of parallel lines becomes somewhat complicated. If the lines have identical characteristics and are equally loaded, it is advantageous to control both with the same regulator, but if the lines have different characteristics or it is desired to load them unequally, each line should be controlled by its own regulator. For the latter case the use of single-phase regulators or a transformer with taps and dial switches does not give the best results, even though the resultant voltage is in phase with the impressed voltage, for the reason that they do not compensate for the line drop in both value and direction. A single polyphase regulator in each line is more objectionable in that the regulator itself introduces a phase displacement. Proper and correct voltage compensation can, however, be obtained by the use of two polyphase regulators connected in series with each line, as with this arrangement and by an independent adjustment of each regulator the line drop in both value and direction can be compensated for or the load may be divided as desired.† The synchronous booster set is also applicable, provided the stationary members of the set are relatively adjustable so as to compensate for the phase displacement required. However, the impedance of a regulator, referred to the line voltage, is relatively small—probably about 1 per cent. Hence, with unlimited power and with sustained voltage any regulator under a line short circuit may be subjected to enormous overloads even up to 100 per cent. Under this condition the synchronous set is not so safe as the induction regulator which has no rotating parts.

With the exception of the transformer with a variable ratio, no design of voltage regulator can economically be wound for a voltage exceeding 15,000. Hence, when regulators are required to control high-voltage lines it is necessary to provide an exciting or step-down transformer for the primary winding of the regulator and a series or insulating transformer for the secondary or series winding. The secondary of the regulator is connected directly to the primary of the series transformer and the secondary of the series transformer is connected in series with the line to be regulated. With this arrangement it is necessary to arrange the windings of the transformers and of the regulator so as not to introduce a phase displacement due to the connections; that is, with the regulator in a maximum boosting or lowering position, the resultant induced voltage of the regulating outfit must be in phase with the bus or line voltage. Both transformers must also have a slightly higher kva. capacity than the regulator itself. The exciting transformer must have a capacity equal to that of the regulator including its over-ratio and must also supply the losses in the regulator and series transformer. The series transformer must have a kva. capacity equal to that of the regulator including its over-ratio.

The transformer with a variable voltage winding is the most economical regulator and can be used directly in higher voltage circuits than any other means of voltage regulation. The voltage regulation, however, is in steps; consequently, since it is generally desired to make voltage adjustments under load, it is necessary to use a somewhat complicated switching mechanism.

The synchronous booster set requires an exciting and a series transformer, as does also the regulator. Furthermore, the synchronous motor and the booster must each have a kva. capacity equal to the voltage regulation required. That is, the regulating equipment must have a total kva. capacity four times the regulation required; hence the losses are high.

The induction regulator with its exciting and series transformers has a kva. capacity three times the voltage regulation required. The voltage regulation is gradual, no switching of line current is required, and as the regulator has no continuously rotating parts it is somewhat safer under line short circuits.

The combination of a transformer with taps and an induction regulator has the advantage of low losses and a gradual voltage change, but the arrangement is somewhat more complicated than the transformer with taps and switches only.

The synchronous condenser, when used on a high-voltage line, also requires a step-down transformer.

FUNCTION OF SYNCHRONOUS CONDENSER

Although the function of the synchronous condenser is primarily to supply a wattless current to the load, thereby increasing the capacity of the generating, transforming and transmission equipment or reducing the losses therein, it may properly be classed as a voltage regulator, although the regulation of voltage is only incidental and depends on the line and load constants and the lowering of the voltage can only be obtained by loading the line with a wattless current. The function and the action of the synchronous condenser have, however, previously been presented from various angles and viewpoints and hence require no further comment.

From the preceding it will be observed that the control of high-voltage lines is expensive owing both to the initial cost of the apparatus and to the losses. However, instances have occurred—and they will continue to occur in increasing numbers as the paralleling of lines and interconnections increases—in which this control is economical or even essential because the lines cannot be operated without the use of feeder regulators.

Location of the regulator is also an important factor. The adjustable-voltage transformer is generally installed in the generating station, although it is frequently installed at the tie-in point of an interconnected system. The induction regulator should be installed in the station from which the power supplied to the line is obtained so as to avoid carrying the exciting and, in the boosting position, the primary current of the regulator, which loads the line with an additional current, thereby increasing the line load and hence the voltage drop as well as decreasing the power factor of the load carried by the line. The synchronous set may be installed at any desired point, and advantage may be taken of the fact that the synchronous motor may in part be used as a condenser. The synchronous condenser is preferably installed at the load.

†This particular phase of the subject was presented and fully discussed and illustrated on page 140 of the *Electrician* (London) of Nov. 6, 1914.

Central-Station Utilization of Byproduct Power from Steel Plants

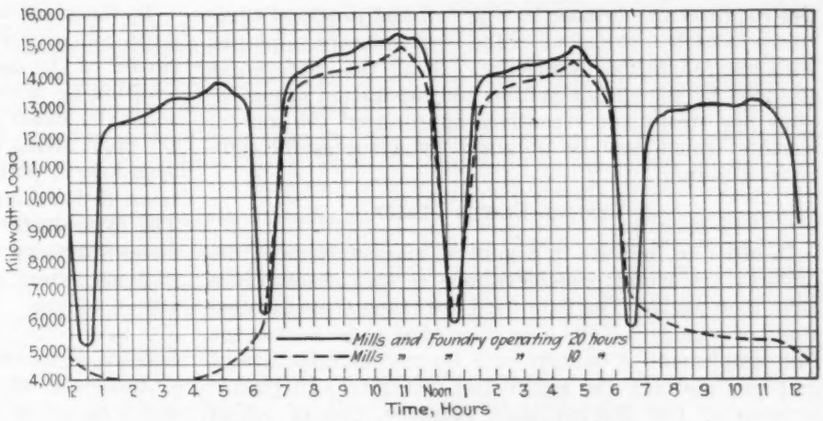
Opportunity for an Economical Interchange of Electrical Energy and the Conservation of Waste Heat Developed in the Steel Industry—What the Data from a Fully Electrified Plant Show

By L. B. BREEDLOVE
Consulting Engineer Chicago Trust Company, Chicago

WHILE gas companies have, whenever the opportunity offered, co-operated with the steel industry in the conservation and sale of gas from coke-oven plants, little if any progress has been made by electric power companies toward utilizing the waste energy product at steel mills and blast furnaces. This has been due largely to the fact that the conversion of waste heat into salable electrical energy involves a more complicated process than the mere distribution of byproduct gas. There exists, however, the possibility of very real economies for both the steel mill and the central station in the combining of their respective resources to utilize the energy which is now being absolutely thrown away.

The steel industry requires large quantities of electrical power and produces large amounts of byproduct energy suitable for the generation of power. The amount of energy consumed and the byproducts produced depend upon the number of departments and the volume of production. Practically all the byproducts suitable for power generation excepting waste heat are produced in the blast furnace and byproduct coke departments, while these departments consume about 15 per cent of the energy required in the manufacture of rolled-steel shapes from the raw materials. The rolling department is the largest consumer of power among the departments and takes about 70 per cent of the manufacturing total and produces no byproducts. The open-hearth department requires about 5 per cent of the manufacturing total and produces considerable waste heat suitable for utilization. Thus a plant producing pig iron as a product would consist of blast furnace and byproduct coke departments having large quantities of products for the generation of power which will produce far in excess of their energy consumption. A plant producing rolled-steel products but not manufacturing its own cast iron would have the opposite power conditions. In a plant having the full complement of departments proper utilization of the byproducts will produce all the power required for the plant's operation and in addition a surplus.

The most economical arrangement theoretically between an industrial plant utilizing available byproducts for power generation and a central station is a connection for interchange of power. Ignoring all other possible economies, the saving in the investment for reserve capacity would alone warrant this interconnection, even if no power were normally transmitted in either direction over the tie lines. If the isolated power plant can be linked with an interconnected superpower system, the idea is more attractive. This would require a coordination of the operation of both stations, which would practically mean the operation of the isolated station by the central-station organization. This may be generally hard to arrange, however, and probably the best way would be to work out the engineering economies without regard to the rate question of either power or byproducts and to have a joint committee study the cost relations. Where the industry is of sufficient magnitude, as in the case of the large steel plants, a subsidiary operating company, whose stock would be controlled by the two interested corporations, could be formed.



EXPECTED DAILY LOAD CURVE OF STEEL PLANT

This method would provide a flexible means of adjusting rates for byproducts and power to give to both organizations a fair profit on the investment. It would also decrease the amount of investment required from either organization under any present plans, remove certain commercial and personal elements, bring central-station operating methods to the steel industry and add another source of power to the central-station system at a moderate capital outlay with low production costs for energy. This would surely be a distinct step in advancing the industrial development of this country and in the conservation of national resources.

In localities where several steel plants are situated considerable saving in the total investment can be made by grouping the blast furnaces, coke plants and power plant together. In localities where several companies are operating the future may see the blast furnaces, coke plants and central station grouped together near a waterway, while the other departments may be located some distance away.

The operation of a power plant by steel mills is secondary to the production of steel and is therefore seriously handicapped in its technical staff and methods. The foremost attention of the engineers attached to the steel industry is directed principally to the application of electric power to the industrial operations. The production of power has become a separate industry requiring highly specialized operators. This fact is being more appreciated each year by the steel industry. The load curves of steel plants are becoming more and more desirable for central stations, and the peak-load periods do not ordinarily coincide with the peak-load hours for central stations.

Central stations have not in the past been able to contract for a large part of the electrical requirements of the steel industry. This has been due to the lack of knowledge of the plant operations and the factors connected with the availability of the several byproducts. The principal interest of the steel engineers is devoted to power application in the operation, rather more as it relates to increase in production than to power cost saving. Thus power generation from the byproducts as produced has not had the attention it deserves from steel men or central stations. A study of the possibilities requires an engineer having full and practical experience in each department of the steel industry combined with central-station experience. In all the conferences attended by the author neither central-station organizations nor steel-plant executives appreciated the mutual benefits which may be obtained by a successful commercial plan.

A Typical Power Plant

In order to indicate in a general manner some of the important economic considerations certain assumptions have been made. The data used are taken from detailed study of a modern, fully electrified steel plant having the full complement of departments for the manufacture of cast-iron castings and rolled-steel products. This plant consists of five 500-ton blast furnaces, two of which supply the foundry and the others the open-hearth department. The foundry is equipped with complete mechanical equipment for large-volume production of small castings. The byproduct coke plant consists of 240 16-ton regenerative coke ovens with complete recovery apparatus for the production of benzol, tar and ammonia sulphate. The mills consist of one 40-in. blooming mill, one 24-in. continuous mill and two 18-in. continuous mills.

The annual production assumed for these mills is 600,000 tons per year of 1½-in. x 1½-in. minimum bar blanks or any weight of sheet bar. Operation schedule of the mills and foundry calls for 310 days per year. The accompanying diagram shows the expected electrical load curve for this plant. The motors throughout the plant were carefully chosen to avoid oversizing. The energy consumption from ore to finished steel per ton is around 67 kw.-hr., and from ore to finished castings at the foundry the energy consumption is 32.5 kw.-hr. The yearly consumption is 58,000,000 kw.-hr. Generating capacity consists of three 12,500-kva. turbo-generator units. Six turbo-blowers capable of delivering 45,000 cu.ft. of free air per minute against 17 lb. gage pressure are installed for blowing the furnaces.

Each 500-ton, or so-called standard, blast furnace will produce, when operating at a rating in excess of the gas necessary to heat the blast, around 2,000,000 cu.ft. of blast-furnace gas per hour, except during the periods of casting, or about two hours per day. This gas with the dry hot method of cleaning comes to the boiler at about 300 deg. F. and contains about 98 B.t.u. per cubic foot. In the wet cold method of removing the dust from the gas the sensible heat of the gas, or about 5 per cent of the total, is lost. This heat loss is a considerable item, and for that reason dry hot cleaning is recommended. With gas containing 0.2 (or less) grains dust per cubic foot at standard conditions (0.2 grains or less dust content is the usual requirement), the maximum boiler load which can be carried with one tube blowing per day shift is about 190 per cent. Our standard furnace will supply continuously, except at casting times, about 3,600 boiler-horsepower, which at 155 per cent rating calls for 2,300 hp. units. These large units, fired by blast-furnace gas and pulverized coal, permit a lower investment than separately fired boilers and a wide range of capacity in the firing, with lower labor costs and good economy. Tar, coal, coke and coke-oven gas may be fired in the same boiler installations with good economy in addition to the other fuel. This the author has tried over a period of five months in a temporary boiler installation with good success. It is probably an indication of future developments.

In the plant assumed the blast-furnace gas will produce continuously 9,000 kw. During the heavy load period of the day 100,000 kw.-hr. must be produced in addition by other fuel, and this is in addition to generating the steam necessary for blowing each furnace and the plant steam supply over the amount produced at the open-hearth plant. No exact balance between the electrical demand and the supply of furnace gas is possible. The byproducts available in excess of all plant requirements each day in this plant, and which may be stored to some extent for use at the power plant as desired, are as follows: 30,000 gal. tar (18,000 B.t.u. per gal.); 570 tons coke (domestic and breeze); 5,000,000 cu.ft. coke-oven gas (550 B.t.u. per cu.ft.).

Assuming 23,000 B.t.u. per kilowatt-hour produced and a factor of availability of 50 per cent, which is low enough certainly, these byproducts represent 270,000 kw.-hr., leaving approximately 150,000 kw.-hr. which may be sold outside of the plant each day. During periods when the rolling mills are not in operation surplus power will exceed this figure materially. The market value of these byproducts on a B.t.u. basis is lower than that of coal and the most profitable sale is in the form of electrical energy.

Opportunity for Profitable Business

The estimated cost of the power station for this plant is about $5,000,000 complete. The sale of this surplus power alone would bring in a gross income around $1,200 per day, somewhat over 6 per cent on the investment. By improving the load factor and utilizing more fully the byproducts this becomes very profitable business. By supplementing these fuels with pulverized coal a flexible and efficient method is provided for handling load fluctuations. Such a station operating on byproducts and pulverized coal can be made a very important generating station of any connected system and can be operated in such a manner that further economies may be made. In case the mills and foundry do not exist or are not in operation, the tar is increased to 41,000 gal. and the coke-oven gas to 27,000,000 cu.ft. per day. Any successful plan of obtaining the electrical loads of the steel industry should be of great value to central-station organizations.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Electric Overhead Distribution Maps for Central Stations

MAPS of overhead systems must be readily intelligible to every one who has occasion to use them, according to a paper presented by H. S. Chartier of the Fulton County Gas & Electric Company (Gloversville, N. Y.) before the convention of the Empire State Gas and Electric Association at Utica, N. Y., in May. The maps must be easily made and not difficult to maintain and must be in easily accessible places and protected from dust and exposure.

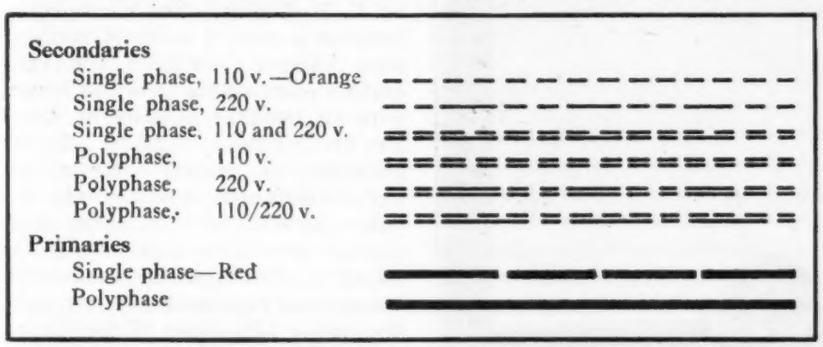


FIG. 1—METHOD OF MARKING SECONDARIES AND PRIMARIES ON DISTRIBUTION MAPS

Plain paper prints are not sufficiently durable. Paper with a cloth back is not suitable because the ink will penetrate the paper, and when erasures are made a hole results which allows the ink to smear over the cloth. The maps should preferably be blue-line prints on cloth. These prints are extremely durable, do not crack, stand erasing and do not smear when ink has been applied over an erasure.

The making of these prints is somewhat expensive as it is necessary to prepare a tracing and a Van Dyke. However, streets do not change frequently, and it is seldom necessary to remake a tracing or Van Dyke, but merely to have additional prints made when the maps are worn out or the electric information on the distribution maps becomes obsolete.

There are many ways of mounting maps, and where there are a large number to display they will presumably be mounted on rollers similar to the ones used for window shades or flat on some composition board. The first-mentioned plan has the advantage of being very cheap and of holding a considerable number of maps in a comparatively small space. The rolls can be supported in a cabinet with a swinging door so as to keep them free from dirt. This method has a few disadvantages, however, that are not present in the other. When the maps are rolled there is a tendency to break the surface and thus reduce the life to a considerable extent. This method does not allow the use of marking tacks.

The second style of mounting is considerably more expensive but is at the same time much more satisfactory. The supporting frame may consist of a vertical standard to which are hinged the composition-board sheets in a light metal frame so that they swing as sheets in a book, or they can be mounted in thin drawers in a cabinet which allows them to be pulled out. The frames should be at least 36 in. x 48 in. and may be as large as 42 in. x 60 in. The larger sizes are particularly desirable as they allow the ordinary village of one or two thousand inhabitants to be shown on one page with a scale of 100 ft. to the inch. A city of ten to forty thousand requires about eight or ten pages on the same scale. Ten to forty maps can be supported on the ordinary commercial frames.

The scale of 100 ft. to the inch will probably be found most desirable for ordinary construction. Very light construction can be shown on a scale of 200 ft. to the inch, and in extremely congested districts the

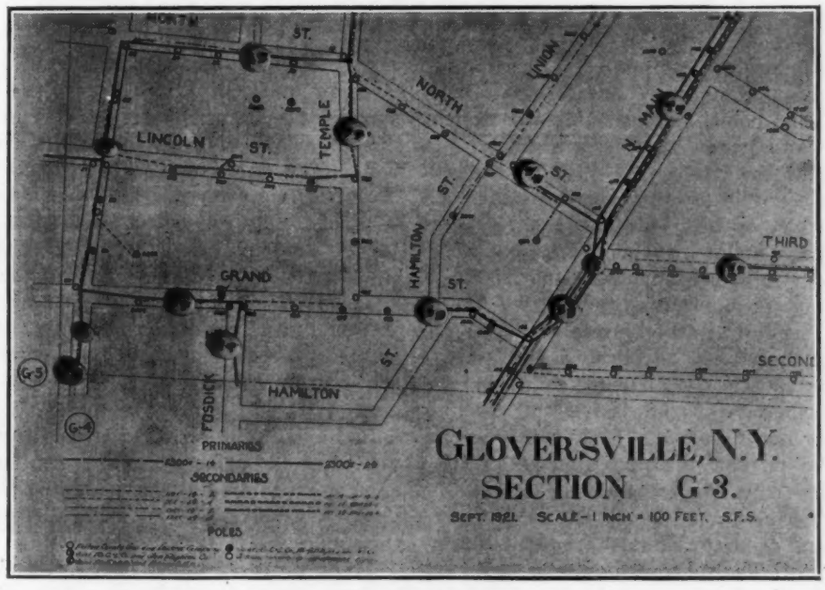


FIG. 2—DISTRIBUTION MAPS MUST BE EASILY MADE AND NOT DIFFICULT TO MAINTAIN

scale of 50 ft. to the inch should be ample in most cases. The 100 ft. scale allows for more than half a square mile on one map of the large size. The blue-line print is somewhat more desirable than the black as it allows the electrical construction to show more prominently, and incidentally it is about 10 per cent cheaper.

As regards the various parts of the distribution work, the supporting structures are the first essential in building a line. For poles a rubber stamp with a ½-in. (inside diameter) circle will facilitate marking the location. A black pad can be used for poles owned by the company and red or purple for poles of foreign companies. Presumably most companies are blessed with joint poles, and probably the easiest way of showing this is to fill in one-half the circle. By dividing the circle vertically and coloring either the right or left half the electric company makes provision for two different joint relationships, and by dividing it horizontally for two more. The fully colored circle would denote a three-party ownership, and as that is usually the ultimate condition the coloring is progressive and erasing is not required. Pole numbers can be put on the map in ink as they are of a nearly permanent nature.

Lines are the greatest variable and require the most frequent changing. The scheme should be such that in the change a minimum of erasing will be required. Primaries are the first essential, but as the system grows it is the secondaries that are most frequently extended. When they become loaded they are changed over to primaries and extensions again made. Using orange for secondaries and red for primaries allows for this logical method of growth without erasing. This is shown in Fig. 1.

The very important step of the connection between primary and secondary has not as yet been considered. This is probably the cause of destroying more perfectly good maps than any other thing, for transformers are the floating population of the electrical industry. With maps on rollers there is little that can be done other than to draw a circle or mark an X by the pole supporting the transformers and print the capacity and companies' numbers. The flat mounting allows the use of celluloid-covered tacks. White with black figures is the most satisfactory. The ⅜-in. tack is large enough for one transformer and the ⅝-in. for two or three. These are very inexpensive and provide an extremely flexible method of showing the location of transformers without destroying the maps.

Sectionalizing switches, lightning arresters and other apparatus can be shown on colored tacks which have a flat surface for convenient lettering.

Maps properly made on cloth and mounted flat should have a life of at least ten years so far as the electrical record is concerned, and a draftsman should be able to fill in the construction on one page in one or two days. This is particularly desirable as extensive rebuilding might make a section obsolete, and it would be simpler to make a new one than to attempt to correct the old.

FIG. 3—HINGED SUPPORTING FRAMES FOR MAPS WHILE SOMEWHAT EXPENSIVE GIVE THE MOST SATISFACTION

Cost of Automatic Hydro Plant at Searsburg

DETAILED costs of the recently completed hydro-electric plant of the New England Power Company at Searsburg, Vt., were filed with the Massachusetts Department of Public Utilities by President H. I. Harriman a short time ago. This station is an automatic installation and was described in the ELECTRICAL WORLD for May 19, on page 1143, by E. B. Collins. The construction involved a dam, 4 miles of wooden-stave conduit, penstocks and generating plant on the Deerfield River, with an installed capacity of 4,500 kw. using a head of 245 ft., the installation of control circuits, an auto-transformer, quarters for required attendance, land, surge tank, outdoor substation, right-of-way for 18,413 ft. of conduit line, headworks, flowage and riparian rights for pond area along both sides of the Upper Deerfield for 23,000 ft., aggregating 380 acres. The total cost, subdivided in the accompanying table, was $1,939,689, or $431 per kilowatt of capacity installed.

COST DATA FOR 4,500-KW. HYDRO ELECTRIC PLANT

Local and general camp operation, field engineering, etc.	$109,737
Construction plant	115,858
Preliminary surveys, test pits, roads, etc.	62,501
Dam and appurtenances	163,316
Conduit, 96-in. wooden stave with concrete cradles	481,537
Surge tank, steel, 50 ft. x 35½ ft.	30,878
Penstock, steel, length 550 ft., diameter 8 ft.	21,388
Power-plant building, steel, concrete and brick, 33 ft. x 40 ft.	48,579
One 6,200-hp. I. P. Morris turbine	53,478
Miscellaneous equipment	2,483
One 5,000-kva. G. E. generator, exciter, etc.	76,394
Testing and starting	1,870
Auto-transformer, for stepping up 22-kv. energy at Mount Mills	8,334
Property for operator's quarters, as needed	3,658
Control circuit for automatic operation of plant	3,286
Sub-total	$1,183,403
Contractor's and engineering expense	183,427
Contract payment for dam and pipe line construction	24,000
Land for plant, surge tank, penstocks, outdoor substation, conduit right-of-way, flowage and riparian rights	520,000
Interest during construction at 6 per cent	31,333
Credit on removal of 165 telephone poles	2,475
Total Searsburg plant	$1,939,689

Combined Local and General Lighting Best for Machine Shops

BY J. J. MCLAUGHLIN
Illumination Bureau, Westinghouse Lamp Company, New York.

FREQUENTLY when fairly good general lighting is installed in a plant there is a tendency on the part of the executives to believe that the lighting problem is entirely solved. While it is true that in the general run of work of shops, such as machine shops, overhead illumination of the proper type will provide sufficient illumination, there is none the less generally some very fine bench and machine work that requires local lighting of high intensity. This might make it seem that lighting of an entirely local nature would be preferable, but this leaves dark spaces and corners between machines that are extremely dangerous. With a well-balanced system, it is often possible to reduce the general illumination, allowing a sufficient intensity for ordinary work and installing local lighting units for fine work, thereby providing better illumination at a lower cost.

An ideal machine-shop installation, upon which numerous tests have been made, has recently been completed by the Westinghouse Lamp Company in its Bloomfield (N. J.) plant. This shop consists of twenty-six 20-ft. x 20-ft. bays with 12-ft. ceilings. The ceiling and walls to a distance of 5 ft. above the floor are painted white, while the rest of the wall is painted a buff color. The overhead illumination consists of 150-watt gas-filled lamps, bowl-enameled, with "RLM" reflectors spaced 10 ft. apart and mounted 9 ft. 6 in. from the floor. This makes an average of four units to a bay. The four units are controlled by a ceiling pull switch in the center of each group, thus permitting a flexible and economical control.

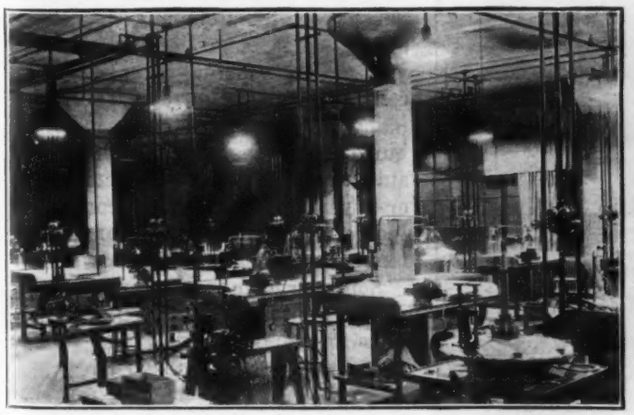
The local lighting consists of 50-watt "Mazda" lamps with Westinghouse standard bowl reflectors and adjustable arm brackets. These units are mounted on the back edge of the benches in a position that permits the arm bracket to be adjusted in any position that the workman may desire or require. The overhead system provides an average intensity of 10 foot-candles throughout the room, which is sufficient for ordinary work. When local lighting is used with general lighting from 40 foot-candles to 50 foot-candles is thrown on the plane of work.

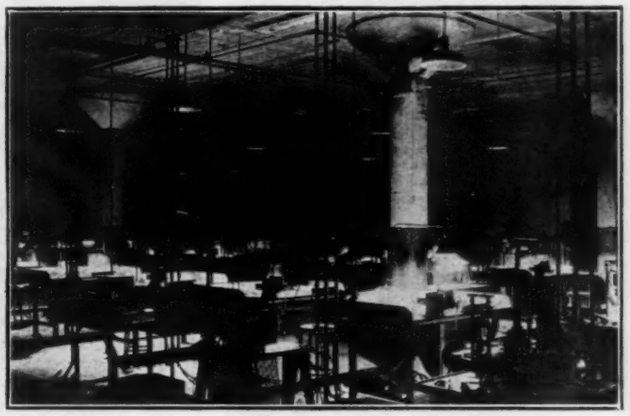
Indiana Utility Uses Hard-Drawn Wire

BY J. W. WALKER
Operating Superintendent Traction, Light & Power Company, Anderson, Ind.

AFTER several years of experience with hard-drawn wire for use in rural transmission, the Traction, Light & Power Company, Anderson, Ind., is now using this type of wire on all its new construction work. Some of the primary advantages in the use of hard-drawn copper over the softer grades are: (1) The appearance of the line is better; (2) the line will stay up with the same sag it had when being pulled, and (3) there is but little difference in the initial cost of hard and of soft wire.

The only objections to this grade of wire are voiced by the linemen, who claim that it is harder to work with. Undoubtedly more care must





FOUR VIEWS SHOWING (TOP LEFT) DAYLIGHT, (TOP RIGHT) GENERAL, (BOTTOM LEFT) GENERAL AND LOCAL, AND (BOTTOM RIGHT) LOCAL ILLUMINATION IN MACHINE SHOP

Notice in Fig. 2 the even distribution of light throughout the room. In Fig. 3, where general and local lighting is in use, the effective illumination is practically the same as the good daylight illumination shown in Fig. 1. Fig. 4 represents the same part of room with the general lighting units turned off. This leaves dark spaces and dangerous corners between machines and benches.

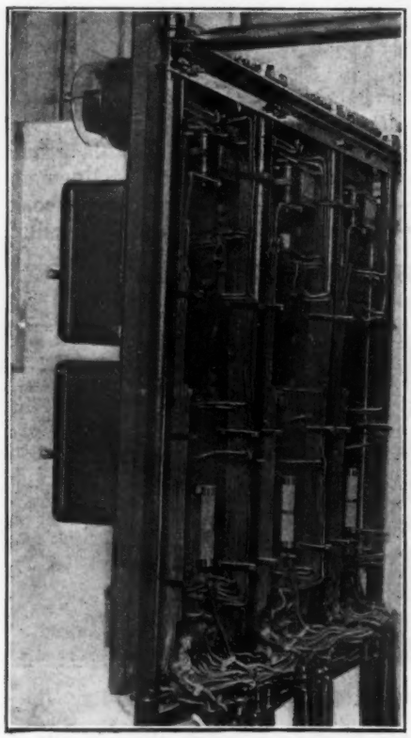
be given it to prevent kicking, but a little patience will go far in making the linemen realize that a line well strung during the time of construction will mean less time wasted later on in repulling.

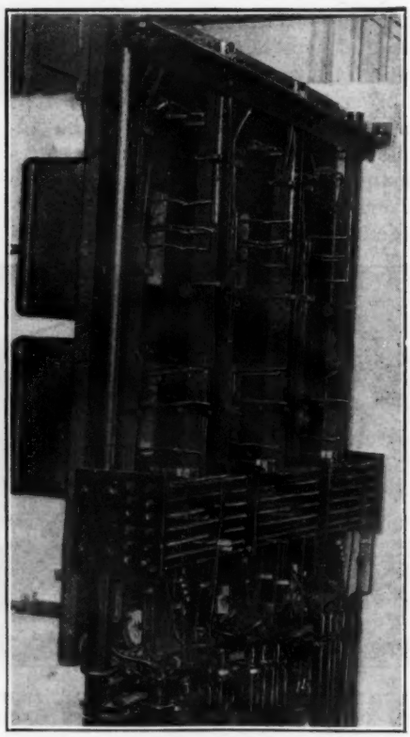
An argument against the use of this grade of wire which relates to the danger of it snapping during sleet and snow storms can be refuted by testing the tension on the line with a dynamometer. With this precaution there need be little fear of going beyond the safe margin of the rupturing strain. A word of caution might be given to linemen not to exceed this limit despite their desire to build a line with only a slight perceptible sag.

Crowding of Switchboard Wiring Avoided

BY D. D. CLARKE
Electrical Engineer Kansas City Power & Light Company, Kansas City, Mo.

THE usual method of bunching wires as they come from conduits at the back of a switchboard panel, as shown in Fig. 1, makes trouble hunting a difficult job. To get away from this, the "open-bus" wiring method shown in Fig. 2 is used by the Kansas City Power & Light Company. This is used for all connections from the conduits that are joined to more than one point on the switchboard. Connections are readily traced, and time of repair men as well as time out of service for the switchboard itself is saved by the open arrangement. The appearance is also much neater.





FIGS. 1 AND 2—EXAMPLES OF IMPROPER AND PROPER SWITCHBOARD WIRING

Distribution by Aerial Cables Increasing

BY F. A. WESTBROOK,
Formerly Field Engineer Habirshaw Electric Cable Company, Yonkers, N. Y.

EXTENSIVE inquiries have indicated that aërial cables for power transmission and distribution have been used sporadically over a wide range of territory. This practice until very recently has been more in the nature of a means of getting around some specific and peculiar difficulty under exceptional conditions than a standard method of construction. Recently, however, the realization that aërial cables can be regularly used in localities where open-wire construction is too hazardous or otherwise impracticable and where underground conduit is too expensive has been gaining ground.

For instance, the Westchester Lighting Company, which two years ago had only a small amount of aërial cable in service, now has several miles and is planning the installation of a good deal more. This cable has been adopted as one of the standard methods of construction of this company.

One of the principal forces which have given impetus to this method of construction has been the problem of serving the large single consumers of power which have arisen during the recent rapid progress of industrial electrification. It has been desirable to distribute at high voltages, but open-wire circuits within congested areas have been too dangerous, and the density of consumption of power along the route frequently too low for an underground system, so that aërial cables are being resorted to more and more. Then the concentration of generating machinery in large central stations with many substations scattered over a wide area of thickly settled suburban territory has also made the use of aërial cables desirable for high-voltage feeders to substations, on account of the danger of open wires, the greater assurance of continuity of service with cables, and the question of tree trimming.

AËRIAL CABLE GIVES SATISFACTION

So far as is known, aërial cables have always given satisfaction to those who have had occasion to use them, but it is also true that the practice is not yet general or even considered by a great many central-station companies even among the largest in the country. This was shown at the annual meeting of the Pennsylvania Electric Association at Pittsburgh, where a paper on this subject was read and discussed. The discussion so far as the central-station companies were concerned was mainly in the nature of asking questions. Most of those present had had no experience in this line. The single exception was the Duquesne Light Company of Pittsburgh, which is probably the largest and most consistent user of aërial cables in the country. There are many miles of such cable in Pittsburgh, and the practice has been standard with the company for several years wherever the conditions indicated the advantage of its extensive use.

Some large industrial plants, such as steel mills, where considerations of safety and continuity of service make high-tension open wires particularly objectionable, are also making use of three-conductor aërial cables, and the faith and enthusiasm of the engineers responsible for the supply of electrical power bid fair

to bring about their general use in the near future within the confines of plants covering a large area.

The meeting in Pittsburgh was significant from two points of view —the fact that the question of the use of aërial cables was considered of such importance as to give it first place on the program of the session and the fact that, although it excited a lively interest, there were none present, with the exception of the Duquesne Light Company's representatives and the manufacturers, who could contribute anything to the subject.

Extracts from an Operating Code*

Operation of Turbines that Are Under Load

INSPECTION of apparatus and tabulations of all necessary readings are the most important features to consider under the routine procedure for operating a turbine room. Detailed instructions covering inspection of all apparatus and a tabulation of the readings to be taken are given below.

1. The running engineer or assistant running engineer must make routine inspection of turbines or engines carrying load. Inspect the oiling system, noting temperature, to see that the bearings are not being overheated, that water is flowing to the water-cooled bearings and that proper pressure is being maintained on step bearings.
2. Inspect and adjust the steam seals to maintain maximum vacuum.
3. Oil, at stated intervals of time, any movable parts not automatically oiled.
4. Observe all instructions stated on machines.
5. Inspect the governor on each machine—see that there is no excessive vibration and that the guides of the governor rods are not binding.
6. Enter on the proper log sheet the following: (1) Hourly readings of vacuum, condenser discharge temperature, wet pump discharge temperature, all bearing temperatures, steam pressure, steam temperature, injection temperature, boiler-feed temperature and barometer reading. (2) Daily mechanical test readings at two load conditions, one at approximate maximum load, the other at approximate average load, as follows: Load in kilowatts, steam pressure, vacuum in condenser, step pressure, first-stage pressure, exhaust-steam pressure, number of by-passes open, hot-well or wet-pump discharge temperature and condenser discharge temperature. (3) The hours operation of stoker turbine and steam exciter.
7. Enter on the proper log sheet the following: (1) Designating numbers and hours of operation of circulating pumps, air pumps, wet pumps, boiler-feed pumps, accumulator pumps, heaters and heater pumps, air compressors, river-water pumps, house pumps, vacuum-heating-system pumps, evaporators and pumps and miscellaneous. (2) Readings of integrating meters.
8. At midnight (or other specified time) change the recording-instrument charts.
9. Enter, under "Engine Room Report," any other items pertaining to the day's operation which are worthy of permanent record.
10. The assistant running engineer or oiler on the pump-room floor must make periodic inspection of all auxiliary apparatus, noting (a) on turbine-driven pumps all operations stated for main turbines, in so far as they apply; (b) on pumps the condition of bearings, to see that oil is circulating and that water is being supplied to water-cooled bearings, and (c) on boiler-feed pumps the condition of regulators, to see that the proper differential is being maintained between boiler-feed pressure and steam pressure.
11. The assistant running engineer or oiler must assist the running engineer to get together the readings for entry upon the log sheets.
12. Spray lines on boiler-feed pumps are to be used only when the pumps are becoming steam-bound.
13. Inspect the reduction gears for vibration and see that oil is circulating.
14. Note, at frequent intervals, the discharge pressure on circulating pumps and keep this within operating limits.
15. Inspect heaters to see that proper temperature and water level are maintained and that all automatic valves are functioning freely.
16. On surface condensers note, at frequent intervals, the temperature rise of injection water.
17. On engine-driven auxiliaries lubricate all moving parts not self-oiled and inspect the valve governor mechanism to see that it is in operation.
20. In operating Corliss engines note that the latching of the valve-lifting mechanism is positive. At light loads it may be necessary partially to close the throttle to prevent nipping of the latch plates.
21. To give full instructions for operation and care of machinery under load would cover a vast field as the conditions vary at different stations; therefore what should be done under extraordinary conditions is left to the judgment of the men in charge.

*Abstract from the operating code of the Philadelphia Electric Company.

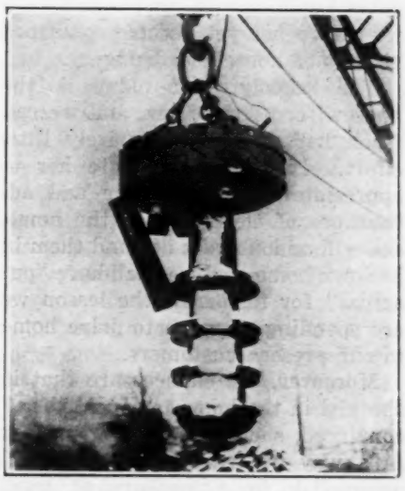
Relay and Oil Switch Trip Test

THE following test should be made every two weeks on each relay and oil-switch trip in generating stations and once a month in substations. The load dispatcher should be consulted as to the time of day at which the test should be made. The test is made to determine whether a relay will operate the oil switch under a heavy current, but it gives no indication of how much current is required or of the time. It does not take the place of the regular calibration test. Following are the rules for conducting this test:

1. The line or circuit whose relays are to be tested must either have its load entirely removed or be in parallel with another, so that its dropping out will not cause an interruption to the service.
2. Close the main oil switch on the line or circuit to be tested, if it is not already closed.
3. Open the relay test switch.
4. Connect the primary side of the relay test box to the proper source of power.
5. Connect one lead of the secondary of the relay test box to ground and the other to the current lead of the relay.
6. Energize the relay test box; this will cause current to flow through the windings of the relay and operate it. Where the relay is of the reverse-energy type, it may be necessary to reverse the primary leads of the test box to operate the relay.
7. Observe the operation of the relay and see that it causes the oil switch to trip and the drop signal or bell alarm to operate.
8. Test the relay on each phase.

Saving $40 Daily by Use of Lifting Magnets

BY THE installation of a 45-in. lifting magnet mounted on a locomotive crane a metal-scrap dealer in Cleveland reduced his operating force from twenty to four laborers without lowering his daily output of 300 tons. His operating costs with twenty men were $64 per day, while his expenses with the magnet and crane, including depreciation, repairs, crane operator and supplies, were only $24 a day. This saving per day of $40, or $12,000 yearly, was almost enough to pay the entire cost of the crane and magnet within a year's time.



HANDLING A BROKEN ROLL BY MAGNET

One advantage of these cranes is that they are not influenced by physical handicaps or weather conditions but are ready for operation at all times. Another is that the control is very simple.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Educational Value of Electric Appliances in High Schools

Progressive Central-Station Policy Yields Good Results—Company Directs Instruction—Testimony of School Authorities Proves Very Encouraging

BY I. R. CARLSON
Sales Manager Houghton (Mich.) County Electric Light Company

EVEN in these enlightened times the reluctance of the experienced housewife to change her methods of performing domestic routine is one of the chief obstacles to the more rapid electrification of the home. Much of this inertia has been overcome, but there yet remain a vast number of worthy housekeepers apparently bent on "getting along" with what they have.

Advertising has proved to be one of the greatest mediums for educating the housewife to make use of electric labor-saving devices, but it does not always accomplish its purpose. Sometimes the housewife fails to read the announcements, or if she does, is not fully convinced. There are, however, many potential housewives—millions of them in fact—who have not yet become confirmed victims of household drudgery.

The schoolgirl of today is the housewife of tomorrow, and we can teach her with comparatively little effort. If we now educate her to appreciate the convenience and advantages of electricity in the home, she will undoubtedly demand them in her own home, and we shall have "put across" for tomorrow the lesson we are spending so much to drive home to our present customers.

Moreover, the chances are that if the girl in the home is educated and convinced, she will reach her mother in a way we cannot, and we shall accomplish in a measure at least what we are striving for.

The home economics departments of our high schools are organized to train their pupils in the management and administration of a modern home. The modern home is an electrical home. Hence we have a common aim with the home economics department in teaching high-school students the use of electrical appliances. They should be teaching our lesson because it is their lesson also. The chances are that they are not doing it. In many cases they have not proper appliance equipment. Probably it will also be found that the teachers themselves do not appreciate the possibilities of electricity.

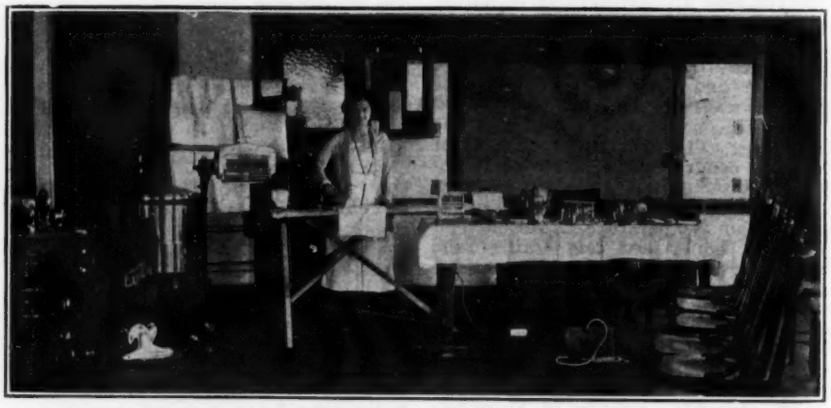
The Houghton (Mich.) County Electric Light Company, a Stone & Webster utility which serves the "copper country" of northern Michigan, has recently done some work along these lines with convincing results. The high schools of the district are all progressive and up to date with good home economics departments, but they were pitifully short of appliance equipment and no attempts were being made to teach anything about it.

In the fall of 1922 this company offered to equip the domestic science rooms of four of the high schools of the district with practically every electrical appliance that should be in common use in the home. The list includes flatirons, sewing-machine motors, percolators, toasters, table stoves, electric ranges, washing machines, vacuum cleaners, vibrators, curling irons, heat pads, mixers and many other appliances. The school boards were not bound to do anything at all in return; there were no "strings" to the offer.

In addition, the company offered the services of a man to demonstrate the appliances to the teachers and to the pupils. The gifts were accepted and the appliances installed, and the company representative gave one demonstration a week in each school in the regular classes until the course was completed.

COMPANY DIRECTS INSTRUCTION

In no case was the manufacturer's name mentioned in connection with the demonstration. The course was purely educational, and any marks of commercialism in the schoolroom would have met with the disapproval of the instructors and would have ended disastrously for the company.



ONE ROOM OF HIGH SCHOOL HOME ECONOMICS DEPARTMENT, SHOWING PART OF ELECTRIC APPLIANCE EQUIPMENT

At the close of the school year the company was invited to assist in preparing an examination for the classes on the subject of the uses of electrical appliances as applied to domestic science, and all questions submitted by the company were accepted. Our representative prepared the questions to emphasize the use of electric appliances in the home and the costs of operation.

The first question had to deal with the reading of an electric meter. Then the students were asked to compute the cost of operating the various appliances for a month with a specified time for the use of each appliance. Other questions were: "What appliances would you buy if you were going to equip a home for yourself?" "Why?" "In what way does electricity help a city to progress?" "Name five uses of electricity in Houghton County," and "What do you think of the idea of placing electric appliances in the high schools?"

The examination brought forth a large number of highly interesting answers which showed conclusively that the average student of the domestic science course had been impressed with the accomplishments of electricity in conducting the affairs of the household and with the economy of its use.

The results of this program, which was attempted at a considerable cost to the company, were watched closely, and in order to check the results of the schoolwork, an exhaustive survey of the communities in which the classes were conducted was made. Surprising reports were received in most instances.

LOCAL SALES BECAME GREATER

One contractor and retailer of electrical appliances in one of the communities wrote the company that his sales have shown a marked increase. Of the recent sales of electric washing machines, more than 70 per cent were made to parents of pupils who attended the classes where the washing machine had been demonstrated.

Other similar reports were received from dealers in electrical appliances, and after an experiment of several months the superintendents of all of the schools are in favor of continuing the course. One superintendent expressed his opinion as follows: "The appliances have been given a fair try-out, and I consider that they constitute a very valuable addition to our school equipment. Electrical aid for the housekeeper is the one progressive step that has been made in home economics in the last generation, and we consider ourselves fortunate to have such splendid equipment available for the instruction of our girls."

We do not hesitate to spend large sums for special campaigns or daily advertising, but it has paid in this case to inspect the schoolrooms and place at the disposal of teachers and pupils electrical appliances which they will welcome and which will bring a greater return upon the investment.

Alabama Power Exhibits at Chemical Exposition

THE opportunities which Alabama offers capital were presented in striking form by the Alabama Power Company at the ninth Exposition of Chemical Industries, held at the Grand Central Palace, New York City, last month, through an exhibit which afforded definite data on the state's natural resources and facilities.

A master map of the state, 8 ft. x 5 ft., portrayed the location of all mineral deposits which have commercial possibilities, sites of all chemical industries, electric generating plants, power transmission lines, substations, towns and cities served with hydro-electric power, transportation facilities, etc. Industrial possibilities were elaborated in detail in a series of smaller charts and maps. In the theater on the exposition floor three motion pictures of the Alabama Power Company, "King Cotton," "Electricity at Work" and "Minerals and Metals," were shown.

The Alabama Power Company has found that participation in industrial expositions of this nature has been very productive of results in bringing new industries into its territory. Plans have been completed by the company to have a booth with several representatives at the International Textile Exposition in Boston and also at the Power Show in New York, both of which will be held later this year.

Hints for Obtaining Electric Heating Load

SOME industrial engineers have yet to be convinced of the superior economy of electrically heated ovens and furnaces for industrial processes. If central-station power salesmen give careful attention to certain well-thought-out suggestions, declares John D. Noyes, Detroit Edison Company, they will be able to present this subject in a more convincing manner.

For example:

1. See that some one person or concern is responsible for and stands back of the oven design and installation.

2. Insist on a guaranteed performance in pounds of metal per kilowatt-hour and see that this figure is in line with the best modern practice. This will require that the electric oven be properly heat-insulated after erection and not merely assembled out of standard parts.

3. Do not discuss industrial heat applications merely on comparative B.t.u. costs of heat supplied. In electric heating a large part of the heat supplied goes into the work; in the combustion process 80 to 90 per cent of the heat in the fuel goes up the stack.

4. The oven should be properly laid out for the work required so that it will not have to operate at partial loads a large part of the time. If an oven is designed for 4,000 lb. of metal per hour, but operated at 2,000 lb. under normal conditions, its efficiency is greatly reduced, since radiation and ventilation losses are more or less constant. It is better that the oven be a little small. Put on a night run when necessary in rush times.

5. In any comparison of costs see that all expenses are covered. This will include fixed charges in the excess investment of the fuel-fired installation, incidental electric power for auxiliary motors, carrying costs of fuel in storage, etc.

6. The combustion process requires careful attention to keep it up to its highest efficiency. Temperature control is automatic, provided that the furnace and all of its auxiliary apparatus are in first-class condition. It appears doubtful that such an oven can be run without higher maintenance expense and more expert supervision than is required by the electric outfit.

7. The depreciation of high-temperature fuel-fired furnaces is high—20 to 25 per cent annually is about the rate of well-established installations and should apply here.

Broader Duties for the Power Engineer

PLACING a new power customer on the "closed business list" soon after connecting him to the central station's system is simply inviting misunderstandings and complaints against the service, warned H. E. Duren, chairman New England Division, N. E. L. A., Power Bureau, at the recent Swampscott (Mass.) convention of the division. Central-station executives should encourage their power engineers to develop closer relations with large customers in order that causes of complaints may be minimized before they assume serious proportions, as is likely to happen under a different policy.

The real work of the power sales department has barely begun with the closing of the contract. It should be the duty of some one in this department to become well acquainted with the engineering force as well as with the executives of the new customer. In many cases where a manufacturing concern has become "electrified" the rank and file of the engineering force, such as the stationary engineers, master mechanics and so forth, have not been consulted, and

often they are antagonistic to the central station for the simple reason that they believe the coming of purchased power means the loss of their positions or curtailment of their importance.

In a typical case an excellent stationary engineer occupied the post of chief engineer of a large New England cotton mill. The officials of the mill decided to purchase power to a large extent, shutting down a portion of their engine plant. The chief engineer immediately started out to obtain another position and finally got one in an engine-driven mill in another city. Within two years this second mill purchased a portion of its power and the engineer moved to a third city, although he remained chief engineer of the second mill for some time after it was partly electrified before he could find a new location. During this time there was hardly a month that there was not a dispute between the power company and the textile company over some item in the bill or the service.

When the third mill also began to purchase part of its power the engineer gave up in disgust and for the first time in his life really attempted to learn something of the details of electric drive. In this he was assisted in every way possible by the power sales department of the central station and he is now an enthusiastic supporter of central-station service.

A little hard work with the men who are actually taking care of installations and are responsible for the successful operation of the machinery in customers' plants will prevent many of the minor troubles which might cause complaint being brought to the attention of the utility executives in much exaggerated form. It is the duty of the power sales department to see that the customer is obtaining the best results from the purchased power. Often in a business depression certain departments of a manufacturing concern will be nearly closed down, but, owing to ignorance on the part of the customer's operating force, these departments will be operated with motors much too large, and hence the amount of power consumed in these departments will not be in proportion to the output.

If some member of the power sales force of the central station will visit the plant frequently he can keep posted as to business conditions and often can show the customer how, by a slight rearrangement of his work or of his motor equipment, a very material saving can be made in his power consumption. This reduces to a degree the revenue of the central station during the period of curtailment, but it is during this period of slack work that the dollars look large to the manufacturer, and the loss in revenue to the central station at this time will be more than made up when business conditions improve.

To accomplish these results it should not be necessary to do anything except rearrange the work of the power sales departments. The more competent men should be relieved of a mass of detail which they are now required to thresh out, thus giving them more time among the customers.

Capitalizing a 500,000-Kw. Connected Load

An advertisement which has to do with
671,581 HORSES
THE wooden horse of the Siege of Troy was an important animal, a useful Dobbin in his way.
But for the purpose of comparison, just set him alongside that other mythical beast whose "horsepower" turns the wheels of industry in Greater Boston.
For on August 29 the Boston horse, animated by electricity, made a new record: Edison Service reached a connected load of 500,000 kilowatts that day. That is the equivalent of 671,581 horsepower.
The Trojan horse admitted a small group of foxy ancients to an almost impregnable city — and changed the story of Asia Minor.
The Boston horse, silent, invisible, on duty always, is hauling away at our hard jobs, lugging our loads, driving our machines, and recording each day a new chapter in the majestic progress of a superlative industrial community.
He is at your service. Stands without hitching, costs very little to feed, requires no clucking, giddapping, or whip, answers to the switch, and a lady can drive him as well as a man.
The Friendly Glow
EDISON LIGHT

A WHIMSICAL but effective advertisement calling attention to the recent attainment of a 500,000-kw. connected load was run in the Boston press a few days ago by the Edison Electric Illuminating Company. The inserted matter emphasized the contrast between the Trojan horse of mythology and the horsepower of modern electric service. A company celebration of this event in its load development was scheduled for Sept. 12, with a nighttime baseball game and other illumination features at the general service buildings of the company.

What Other Companies Are Doing

Dedham, Mass.—Eleven washers and two electric ranges were among the early sales at the Boston Edison Company's intercommunity electrical exposition last week, the first of a series to be held in its territory throughout the coming months. A $3,600 electric player piano was also sold at Community House, where the exposition took place. The company and local contractor-dealers cooperated actively in the displays and a new radio broadcasting station, "WTAT, Edison Light—the Friendly Glow," was opened at Dedham for general publicity purposes, this being the company's first popular broadcasting venture.

Atlanta, Ga.—The first part of October will witness the beginning of construction on a six-story addition to the present general office building of the Georgia Railway & Power Company. Changes to be made in the present building will provide for the installation of a cafeteria and club room in the basement for the benefit of the company employees. The new building will give 14,000 sq.ft. of additional office space, besides an assembly room, 60 x 40 ft., on the top floor and a substation in the basement. This basement is designed to house a 10,000-kw. substation, but 5,000 kw. will be the initial installation.

Wisconsin.—The Bloomfield Farmers' Club invited representatives of the Southern Wisconsin Electric Company to talk to the club recently on accident prevention in electric operation. O. B. Connor spoke and Merle H. Clapper demonstrated the prone-pressure method of resuscitation. In commenting on the instruction given, the chairman of the club complimented the company on its excellent service and the interest it had shown in promoting a wider knowledge of safety rules and methods of procedure in emergency.

Providence, R. I.—Instead of utilizing a new home to demonstrate the convenience and attractiveness of electric service to the public, the Rhode Island Electrical League has opened this fall its second electrical home in a remodeled residence. The house will be open afternoons and evenings from Sept. 29 to Oct. 20 on weekdays. H. E. Dawson, 501 Turks Head Building, Providence, is secretary.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Devices to Reduce Leaving Losses in Steam Turbines.—I. R. Cox.—In the design of large turbines for operation at high speeds the limit of output is almost always determined by the allowable leaving losses at the low-pressure end of the turbine. Consequently, the problem of providing adequate leaving area becomes increasingly difficult at high rotational speeds. The methods of procuring adequate leaving area are dealt with in detail.—*Beama (England)*, September, 1923.

Surge Tanks. — F. JOHNSTONE-TAYLOR.—The laws governing the hydraulic conditions in relation to the speed control of hydraulic turbines are now well formulated, and one of the practical solutions for what has hitherto proved an intricate problem is the surge tank, which consists of a tank connected to the pipe line and placed in such a position as to allow the water to surge therein and by so doing to prevent dangerous rise of pressure in the pipe line consequent upon the closing of the governor gates. General characteristics of both the simple and differential types of surge tanks, and the operation of each, are considered. — *Electrical Times (England)*, Sept. 6, 1923.

Constructing Mitchell Dam on the Coosa River.—L. V. BRANCH.—The construction of this dam and of the power plant, which is to have an ultimate capacity of 120,000 hp., is described in detail. Railroad connections, plant layout, yard and plant railroad, cofferdam and steam control, quarry operations, crushing plant, concrete forms and permanent plant erection are considered. — *Engineering News-Record*, Sept. 27, 1923.

Operation of Hydro-Electric Stations. — RALPH BROWN. — Two conditions under which hydro-electric plants are operated to obtain the greatest output are where there is a limited amount of water and where there is an excess of water. Each of these two cases is considered.—*Power*, Sept. 4, 1923.

Generation, Control, Switching and Protection

Progress in the Design of Steam Turbo-Generators.—R. POHL.—More or less well-known details of the latest developments of steam turbo-generator sets of large capacity which have been previously published in this and other German papers are summarized in this paper. The last chapter, however, contains valuable suggestions as to future possibilities for the more economic and reliable operation of these machines. The author foresees a great future for the totally inclosed generator, cooled by a circulating gas, which is used over and over again without external replenishment. At a suitable point in the wake of the cooling gas, preferably under the generator, a system of water-cooling coils is interposed which absorbs the heat. By utilizing the heated water for boiler-feed purposes the effective efficiency of the generator may be raised from 95 per cent to 96 per cent, which may mean a great saving in fuel on a large machine. It is further pointed out that air, commonly used as gaseous cooling medium, is by no means the most suitable gas for that purpose. Carbon dioxide is too heavy, hydrogen is hard on the packing system, but nitrogen, and particularly helium, would give excellent results. It is claimed that the cooling action of the latter gas would be 25 per cent better than that of air. As neither of these two gases maintains combustion, the generator would be fireproof. — *Elektrotechnische Zeitschrift*, Aug. 9, 1923.

Generator Voltage Regulators.—J. H. ASHBAUGH.—The question as to why direct-current generator voltage regulators cannot be used to control the voltage of an alternating-current generator is explained. The operation of two types of voltage regulators for alternators is described. These regulators must have incorporated in them some feature that will prevent hunting. In one device described this is accomplished by directly utilizing the action of the exciter, while in another the inherent characteristic of a vibrating magnet is used.—*Power*, Sept. 25, 1923.

Transmission, Substations and Distribution

Automatic Alternating-Current Network Protector.—G. G. GRISSINGER.—An automatic alternating-current network protector has been developed for use on single-phase three-wire, two-phase three-wire and three-phase four-wire systems. It consists essentially of an electrically closed and tripped carbon circuit breaker and a group of relays. The principal object of this protector is to disconnect completely any faulty feeder from a distribution system.—*Electric Journal*, August, 1923.

Calculation of Condenser Bushings. —A. SCHWAIGER.—As this paper was written in the high-voltage laboratory of a university it is apparently not backed up by actual manufacturing experience. For this reason the results may or may not check up with those obtained from calculating methods familiar to American designers, which use this type of high-voltage bushing quite frequently. After developing the theory of series-connected condensers, coaxially arranged between a conductor and ground, two sets of curves are given, from which the number and individual height of the condensers may be determined for certain puncture and flashover voltages. The two curves will give a different number of foil layers for puncture and for flashover. In practice, of course, only one number can be used, so that it will be found impossible to fulfill simultaneously equal voltage distribution in a radial as well as in an axial direction of the bushing. A compromise will therefore always mean that a bushing of this type can never be designed with the smallest theoretically possible dimensions. It is of interest to note that the author's method obviates entirely any kind of capacity calculation. As a practical example the design of a bushing for 350,000-volt test voltage is shown.—*Elektrische Betrieb*, Aug. 29, 1923.

General Consideration of T-Type and Pi-Type Artificial Electric Lines.—H. NUKIYAMA and K. OKABE.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. summer convention, July 7, 1923, page 18.—*Journal of the A. I. E. E.*, September, 1923.

Units, Measurements and Instruments

Testing Electric Motors for Open and Short Circuits.—C. SYLVESTER. — The author explains how the ordinary measuring instruments can be used for locating open and short circuits in electric motors. — *Electrical Times (England)*, Aug. 30, 1923.

Determination of Chimney Sizes.—ALFRED COTTON.—The author presents a simple and orderly system, based on accepted characteristics, for determining the sizes of chimneys. He has found that certain essential relations exist between capacity, draft, diameter and height, when connected in the manner he outlines. Charts that are given show the static draft and maximum capacity of chimneys up to 500-ft. height and 25-ft. diameter, from which the working draft and capacity are found by means of the fundamental curve. Other charts give factors for various atmospheric temperatures, for altitudes and for approximate work based on boiler-horsepower. A problem is worked out to illustrate the use of the chart.—*Mechanical Engineering*, September, 1922.

Illumination

Lighting the Silk Industry with Incandescent Lamps.—H. W. DESAIX.—This paper is based on observations, investigations and experiments conducted by the author to secure for the silk industry a practical system of illumination to replace the present inadequate and impracticable methods. Each process in the manufacture of silk fabrics presents a problem in itself and each has to be so treated. A 250-word abstract of this paper as presented before a local meeting of the I. E. S., may be found in the May 19, 1923, issue of the ELECTRICAL WORLD, page 1168.—*Transactions of I. E. S.*, September, 1923.

Disappearance of Gas in the Electric Discharge.—Experiments that were carried out with evacuated incandescent tungsten lamps indicated that the disappearance or "clean up" of the residual gases by phosphorus is due to the adhesion of the gas to a solid film deposited by the discharge on the walls of the container. Other substances behave similarly to phosporus. The inactive gases are more difficult to eliminate than gases such as oxygen or CO_2, and a possible explanation to account for this difference is suggested. —*Paper presented before the American Electrochemical Society at Dayton, Ohio,* Sept. 27-29, 1923.

Motors and Control

Electric Textile Drives. — W. MÜHLENS. — Specialists in electric textile drives will find a great deal of information on well-established and late developments of European practice in this branch of exacting power drive. The article goes with considerable detail into the mechanical requirements of the drive of all the various machines needed for spinning, weaving and printing of wool and cotton goods. The special characteristics required for each drive are explained from tachometer records taken during perfect operation of the machine under consideration. It is shown when individual drive and when group drive gives the best result. In some cases the same machine is shown with the old steam drive and after electrification. The paper contains a great many photographs and a complete data reference.—*Elektrotechnische Zeitschrift,* Aug. 30 and Sept. 6, 1923.

Checking up Motor-Winding Diagrams.—A. C. ROE.—The author describes the developed type of diagram which shows every coil side and end connection as well as all stubs and jumpers. He then explains the simple single-line diagram and tells how a developed diagram may be changed to the single-line type. This is the first of a series of articles on laying out diagrams and procedure in connecting induction motors.—*Industrial Engineer,* September, 1923.

Heat Applications and Material Handling

Application of Electric Welding to Large Tank Construction.—E. J. RIGBY. An interesting account is given of the application of electric welding in repairing and constructing some of the Melbourne & Metropolitan Gas Company's gas holders. So satisfactory has the company's experience with this method of welding been that all classes of work possible are being welded.—*Journal of American Welding Society,* August, 1923.

Intra-Plant Haulage.—M. W. POTTS. —Various types of tractors and trailing cars that are being used at the present time extensively are described. Some of the advantages obtained from the use of the tractor-trailer system of industrial transportation are a reduced number of men on the payroll, cheaper operating costs, quicker and better deliveries of materials between operations, complete co-operation between departments, increased production, reduction of the amount of materials lost and damaged in transit, etc.—*Industrial Management,* September, 1923.

Electrophysics, Electrochemistry and Batteries

Production of Nitric Oxides and Ozone by High-Voltage Electric Discharges. — K. B. MCEACHRON. — This paper is a résumé of a bulletin of the engineering experiment station of Purdue University, setting forth the results of a series of tests made on a number of different discharge tubes. The design of tubes was such that the action of glow, sparks and glow, and sparks alone, could be studied separately. Tests were made with inclosed volumes of dry air and with moving air at different flow rates. The effect of pressure was also investigated. A new type of ozonizer was developed which produced high concentrations of ozone with only small yields of nitric oxides. The use of a mixed high-voltage discharge produces, under favorable conditions, the higher oxides of nitrogen, which is desirable from the standpoint of absorption. — *Paper presented before the American Electrochemical Society at Dayton, Ohio,* Sept. 27-29, 1923.

Extraordinary Diffraction of X-Rays. —L. W. MCKEEHAN.—The author considers the directed emission of characteristic X-rays from the atoms of a crystal placed in a narrow beam of X-rays containing short wave lengths. The theory presented was developed in attempting to explain the occurrence on photographs taken for the crystal analysis of iron, nickel and copper of spots at places and in positions quite inexplicable by the ordinary theory of X-ray diffraction in crystals.—*Bulletin B-21-1, Western Electric Company.*

Traction

Explosion on an Electric Locomotive. —On one of the single-phase Gotthard locomotives there occurred recently a violent explosion. Investigations disclosed the accident to have beyond any doubt been due to the following peculiar circumstances: A few days before the accident the core and coils of the locomotive transformer were taken out of the tank for inspection. It is assumed that in replacing them in the tank the winding became damaged or else some foreign metallic part dropped into the transformer which, on the day of the trouble, was responsible for a heavy internal short circuit. The arc of this "short" generated a large amount of so-called "oil gases," consisting mainly of hydrogen and methane gas, which escaped from the transformer tank, mixed with air and formed an explosive gas. This gas found its way to the contactors, located next to the transformer, where it was ignited. To forestall similar accidents in the future, a gas relief pipe, which will carry the gases through the roof into the air, is being installed on all locomotive transformers. A further precaution is an airtight seal between transformer and contactor compartments on all the locomotives. — *Elektrotechnische Zeitschrift,* Aug. 23, 1923.

Electrification of Foreign Railways. —S. PARKER SMITH.—In a former article the author considered the railways of Switzerland, and in this issue he discusses the Italian railway systems, which contain some of the earliest examples of main-line electrification in Europe. In the beginning most of the important Italian developments adopted the three-phase system, high-tension direct-current systems not being at the time perfected and the series alternating-current motor being in its infancy. The author considers in detail the large three-phase, 3,000-volt, 15-cycle to 17-cycle lines in Italy, with some observations upon the different types of locomotives developed for this service. There also exist in Italy direct-current lines at 650 volts and 4,000 volts, single-phase lines at 45 cycles and the newest development of the Rome-Tivoli line, three-phase, 45 cycles at a potential of 10,000 volts.—*Beama (England),* September, 1923.

Energy Consumption Reduced in St. Louis. — B. F. THOMAS, JR. — Energy consumption tests made on United Railways of St. Louis have resulted in the installation of meters on 1,420 cars. The initial test procedure and results are described. One of the most important features in the campaign for reduction of energy consumption was the education of car operators. The complete installation resulted in peak load as well as over-all energy reduction.—*Electric Railway Journal,* Sept. 1, 1923.

Telegraphy, Telephony, Radio and Signals

Electrical Loud Speakers.—A. NYMAN.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. summer convention, July 7, 1923, on page 21.—*Journal of A. I. E. E.,* September, 1923.

Line Radio Communication.—A publication giving an introduction to the subject of line radio communication has been prepared under the direction of the Chief Signal Officer of the army with the co-operation of the Bureau of Standards. This pamphlet gives an explanation of how messages are carried to distant points by radio-frequency currents directed over ordinary telephone or power wires.—*Signal Corps Radio Communication Pamphlet No.* 41.

Mercury Arc as an Audio-Frequency Oscillator. — Y. WATANABE. — Investigating the problem of the oscillations produced by means of vacuum valves, such as mercury-arc rectifier tube or a tungar rectifier bulb, which are so soft as to permit ionization by collision, the author found that, besides the pure electrical oscillation, an oscillation could be produced on account of the pure mechanical oscillation of ions, positive or negative, in the arc vapor stream. — *Technology Reports of the Tohoku Imperial University (Sendai, Japan),* Vol. III, No. 2.

New Books

Reviews of the Latest Contributions to
Technical, Industrial and Commercial Literature of Particular Interest
to Members of the Electrical Industry

Die Theorie Moderner Hochspannungs-Anlagen

By Dr. Ing. A. Buch. Munich and Berlin: R. Oldenbourg. 368 pp., illustrated.

The outstanding feature of this text is the attention given to electrostatic effects. The author holds that technical literature has thus far given insufficient consideration to methods of computation dealing with the insulation. An extended discussion is, therefore, justified, with recourse to all available mathematical methods, though as a matter of fact the mathematical demands on the reader are not at all severe. Even vector diagrams are used but sparingly and complex quantities not at all. Graphical methods, on the other hand, are introduced to good advantage, notably for working out the potential gradients in bushings, pin and suspension insulators, whose complicated shape renders analytical treatment practically impossible. Here interesting application is made of the idea of refraction of electrostatic lines of force at the bounding surfaces of media differing as to their dielectric constants. The mode of procedure is illustrated by concrete examples using data from current European practice. Though apparently somewhat tedious, as any solution by successive approximation is likely to be, it seems to get results.

The treatment of dielectric stresses in bushings and insulators, the data on the electrostatic capacity and power losses of various types, the suggestion of a definition for the efficiency of these devices, and the outlining of a mode of procedure for determining the conditions for minimum weight of material to meet specified requirements, are certainly timely. When the evidence is thus gathered in one volume, it is quite surprising to note the progress that has been made during the past few years in attacking analytically the host of problems relating to the behavior of solid, liquid and gaseous dielectrics. Results of American studies on corona are included.

As to cables, the operating voltages mentioned are impressive. Data are given on 30,000-volt, three-phase cables delivered in 1910, with test voltages of 75,000 applied for twenty-four hours and 90,000 momentarily; on a single-conductor cable for 60,000 volts, and mention is made of more recent practice running to 80,000 volts.

A discussion of transients is followed by one dealing with protection against their effects. Computations are shown for the inductance to be used in grounding the neutral of a line, as suggested by Petersen. It is reported that in this way the short-circuit current caused by the grounding of one phase is only from 4 to 15 per cent of the normal charging current.

The book brings together in textbook form a number of topics which well repay unified treatment. It is a valuable contribution to transmission literature.

G. F. WITTIG.

A Manual of Artificial Respiration

By Capt. G. R. G. Fisher. Boston: The Stratford Company. 80 pages, illustrated.

Captain Fisher's instructions are not based on theory or particular knowledge of the reasons for recovery, founded upon medical learning, but upon facts culled from a wide experience with the American Red Cross overseas during the war, from his connection with the British Army Medical Corps and from wide research. The Schaefer or prone-pressure method of resuscitation, which he selects as the most perfect, seems unquestionably to be adopted by all the authorities on artificial respiration. In connection with this method Captain Fisher, in Chapter XIII, dwells particularly on the importance of "counter-shock." His statements and experiences are most instructive. In one case he cites "a lineman was hit by 6,600 volts and fell thirty feet. Even though his left hand was burned off and the arm charred to the shoulder, still his mates actually revived him." This case is identical in nature with one that came under the reviewer's notice and that was reported in the ELECTRICAL WORLD for Feb. 26, 1916. A few further facts in connection with counter-shock and its value may not be out of place here, more particularly as a medical authority has recently taken active steps to have reference to counter-shock eliminated from instructions in connection with the prone-pressure method.

On Nov. 6, 1920, in the ELECTRICAL WORLD, were described in detail two cases occurring six weeks apart, both caused through contact, while the victim was on a pole, with 2,200-volt circuit to ground, the shock being through both hands. In each case the victim's name was shouted in his ear and he was struck on the point of the jaw, recovery being made right on the pole. In all, nine such cases have come under the reviewer's notice. Numerous other instances are on record. Without this evidence Captain Fisher has proved his case. He states on authority that every year a thousand lives are lost from electric shock. The reviewer does not know of any recovery without the aid of a fall or counter-shock, and if seven-tenths of these lives, as is asserted, can be thus saved, is not counter-shock worth while?

W. P. STRICKLAND.

La Radiotéléphonie

By Carlo Toche. Paris: Gauthier-Villars et Cie. 98 pages, illustrated.

In this little book of less than one hundred pages the author finds space for ten photographs of apparatus which add little to its value. Since the book is limited in size the material included could not be fully developed. Nevertheless it is interesting and readable. It is elementary and non-mathematical in character and is intended primarily to give a survey of this phase of radio without attempting to supply detailed information for the experimenter. For example, in the first chapter the author discusses the microphone, the effect of the voice waves on the current, the function of the permanent magnets in the telephone receiver systems of transmission including ordinary wire, carrier current and radio, and the necessity of undamped waves and how they are produced. Within the limits of twenty-three pages a detailed discussion of the various elements is impossible. However, the question of the production of undamped waves is somewhat amplified in the thirteen pages devoted to the arc and the high-frequency alternator, including some historical references and numerous diagrams showing how modulation may be obtained, and in the twenty pages on the use of vacuum tubes in radio telephony, including the characteristics and construction of the vacuum tube, the production of undamped waves, high and low frequency modulation and so forth. The remainder of the book takes up reception and the application of radio telephony. The treatment is logical and concise and makes one wish the author had expanded his subject.

H. M. TURNER.

Books Received

Electrical Vibration Instruments. By A. E. Kennelly. New York: Macmillan Company. 450 pages, illustrated.

English for Engineers. By S. A. Harbarger. New York: McGraw-Hill Book Company, Inc. 266 pages.

Principles of Direct-Current Machines. By Alexander S. Langsdorf. New York: McGraw-Hill Book Company. 470 pages, illustrated.

Practical Electroplating. Fifth edition. Revised and enlarged. By W. L. D. Bedell. 407 pages, illustrated.

The Elementary Principles of Lighting and Photometry. By John W. T. Walsh. New York: E. P. Dutton & Company. 220 pages, illustrated.

A Textbook of Intermediate Physics. By A. Moore. New York: E. P. Dutton & Company. 824 pages, illustrated.

Alternating Currents, Their Theory, Generation and Transformation. By Alfred Hay. London: Harper & Brothers. New York: D. Van Nostrand Company. 420 pages, illustrated.

Kent's Mechanical Engineers' Handbook. Robert T. Kent, editor-in-chief. Tenth edition, 1923. New York: John Wiley & Sons. 2,247 pages, illustrated.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Hoover Takes Up Superpower

Secretary of Commerce Invites Heads of New England and Middle Atlantic State Commissions to Confer on This Subject in New York

CHAIRMAN of public service commissions in the Northeastern States, on invitation of Secretary of Commerce Hoover and with the approval of President Coolidge, are to meet in New York today (Saturday, Oct. 13), in the United Engineering Societies Building, for a preliminary discussion of steps that may be taken properly by federal and state authorities in the promotion of superpower development in the New England and Middle Atlantic States to meet the "growing, insatiable and general need for power." Members of the federal Superpower Survey that investigated the subject two years ago will also attend the meeting.

The aim of the conference, as officially announced, is to discuss steps toward a more effective co-ordinated power production between public authorities and industries in the interest of the public, to the end that the widest possible use may be given to the advances made in the development of electric power and to achieve the highest possible national economy in power production and distribution through interconnection of power supplies between existing great utility systems and in common action for the erection of large units of production at advantageous points for the mutual supply of two or more of the present systems and in the national development of great water-power resources.

Ten States to Be Represented

Among those who will attend the conference are William A. Prendergast, chairman New York State Public Service Commission; Commissioner E. E. Stone, Massachusetts Department of Public Utilities; William C. Bliss, chairman Rhode Island Public Utilities Commission; Walter A. Dutton, chairman Vermont Public Service Commission; Richard T. Higgins, chairman Connecticut Public Utilities Commission; Harry V. Osborne, chairman New Jersey Board of Public Utility Commissioners; W. D. B. Ainey, chairman Pennsylvania Public Service Commission; Ezra B. Whitman, Maryland Public Service Commission; Charles E. Gurney, chairman Maine Public Utilities Commission; William T. Gunnison, chairman New Hampshire Public Service Commission; William S. Murray and E. S. Buckland of the Federal Superpower Survey of 1919; M. H. Aylesworth, executive manager of the National Electric Light Association, and O. C. Merrill, executive secretary of the Federal Power Commission.

Jewett Eulogizes Millikan

Speaking for Presentation of Edison Medal, He Describes Physicist's Main Achievements

THE Edison medal for especially meritorious achievement in the field of electricity was presented at the Pacific Coast convention of the American Institute of Electrical Engineers, held at Del Monte, Cal., last week, to Prof. Robert Andrews Millikan of the California Institute of Technology.

R. A. Millikan

This award is the highest which the electrical engineers of America can pay. The presentation was made by Dr. F. B. Jewett, who spoke from New York over the transcontinental line of the Bell System. Dr. Jewett was president of the A. I. E. E. at the time the award was voted. A "public address system" installed in the convention hall made his words audible to every one present.

Dr. Jewett said, in part:

"Probably the best known and most noteworthy of Millikan's works are his so-called 'oil-drop' experiments, which were undertaken for the purpose of making precise measurements of e, that is, of the fundamental electrical quantity. These experiments proved conclusively that all electrons are alike, and the results obtained by Millikan have been of inestimable value in the calculation of physical constants.

"Second only to the oil-drop experiments is Millikan's work on photo-electric effect and his measurement of the so-called h constant. This is a universal constant of fundamental importance in the structure of the atom and in the relations between matter and radiation. Its meaning is doubtless not yet fully clear. By identifying and measuring this constant in his experiments on photo-electric phenomena Millikan made a very important contribution to modern physics.

"More recently Millikan's work has tended toward a definite bridging of the gap between light and X-ray phenomena. By this work he has pushed the ultra-violet spectrum down about two octaves, or nearly, if not quite, to the long-wave-length X-rays."

Dr. Jewett characterized Professor Millikan as being "in the first rank of physicists as a great consolidator and experimenter." He went on to say:

"Reference should also be made to the *Physical Review* papers of 1923 on the coefficient of slip, the reflection of molecules, and the complete law of fall of a particle through a gas at all densities. These 1923 papers establish both theoretically and experimentally the complete solution of the law of motion of particles through a gas.

"Among minor contributions may be named the establishment of the non-dependence of the photo-electric effect upon temperature, the experimental proof of the fact that a light wave may impart an energy to a free electron of the metal, the relation between the contact potential of a metal and the photo-electric work function, the determination of the law of Brownian movements in gases, the conditions for the detachment of two electrons from a single atom by the impact of an alpha or a beta particle against it, the non-existence of an intense penetrating radiation in the upper air, the extraction of electrons from metals by intense applied fields.

"All of Millikan's important contributions to experimental physics have been in the region which is particularly important to electrical engineers."

Dr. Jewett referred also to Professor Millikan's work during the war and in the formation of the National Research Council and to his influence as a producer of men.

Interconnection Study of New York State

Empire State Gas and Electric Association Discusses Possible Super-system, State Regulation, Rural Lines, Rates, Accounting Systems and Inductive Co-ordination

MORE than two hundred representatives of New York electric and gas utilities gathered at Lake Placid on Oct. 8 and 9 at the annual meeting of the Empire State Gas and Electric Association to discuss problems of major interest facing the utilities. Much constructive work was done and a splendid group of papers and addresses was presented.

President M. J. Brayton in his address said that the utilities were never more prosperous and wisely administered or dedicated so truly to the ideal of public service. He predicted a greater use of hydro-electric power and asserted that a few years should see the power generated in the state all poured into one big pool so as to give better service. He stated that such a growth as is now taking place could not prevail if the industry were not built on a sound basis, yet a certain amount of loose talk affects credit and postpones or makes more difficult the rendering of still better service to the public. The association and the member utilities should take action to prevent detrimental legislation, he said, even though they have been accustomed to staying out of politics. The utilities are obligated to give the public the facts of their business in the light of intimate knowledge and experience.

Rural Line Extension

After encouraging reports from the secretary and treasurer, Bert H. Shepard gave the report of the rural-lines committee, which incorporated recommended practices and a rate-schedule formula. The idea presented of rural-line practice in construction was to obtain a line that would involve the minimum annual cost, and the rate schedule approved was one which would add to urban rate schedules a charge to take care of the excess cost of service involved, such as physical investment and cost of line and transformer losses. No direct relation exists between the rate and the amount of energy usage, load factor or diversity factor, the committee said, but if the urban rate schedules consider these elements, the rural user should be charged on the same basis.

W. C. Fisher criticised the report with respect to its general application and stated that usage and the location of customers with respect to power lines were factors that must be considered and that the complicated accounting system involved in determining charges and refunds was an objectionable feature of the recommendations. C. R. Vanneman, chief engineer of the Public Service Commission, thought that the rural question should be faced and some tentative agreement reached by the utilities as to the method of handling the business. He said the report was of a type to permit the commission to consider the question rather definitely as existing practices in respect to handling rural services were extremely variable. The utilities should consider carefully the building up of rural loads. For example, a farmer having a gasoline tractor should not be urged to buy a motor to apply to the same work. E. H. Rosenquest said that capital expenditures could not be standardized unless the method of securing a return was standardized. He thought local conditions faced by each company made it almost impossible to adopt standardized practices for rural services. The report was referred to the executive committee for action.

Intrastate Interconnection

An extremely valuable and timely report on the value of interconnection in the state and the immediate and future economies possible through this means was presented for the transmission-lines committee by the chairman, E. P. Peck.

The committee found that interconnection in New York State to an extent which is entirely practicable would, if lines and equipment were installed, permit the immediate release of 60,000 kw. of present capacity, representing the release of $7,875,000 of capital invested. By 1933 the saving in installed capacity would amount to 237,000 kw., representing a plant investment of $37,125,000.

Outside of the so-called metropolitan district, including New York City, Westchester and Long Island, there are 257 operating companies in the state. Of this number, 194 are dependent wholly or partly on water power, either directly through ownership of power sites or indirectly through the purchase of hydro-electric energy.

Eliminating the Niagara and St. Lawrence plants, it was estimated that the energy generated by hydro-electric plants in 1923 would amount to 1,250,000,000 kw.-hr.; also that an additional 250,000,000 kw.-hr. could be developed by existing hydro-electric plants and used to supply the rapidly increasing load.

Eliminating the plants in the metropolitan district, it was estimated that 500,000,000 kw.-hr. would be generated by steam during the year, and that of this amount 100,000,000 kw.-hr. would be produced from plants of comparatively low efficiency or from plants operating at low load factors.

Assuming that the additional 250,000,000 kw.-hr. which could be produced by the hydro-electric plants is salable at 0.5 cent per kilowatt-hour, and that the 100,000,000 kw.-hr. steam energy at low efficiency would cost 0.5 cent less per kilowatt-hour if generated in high-efficiency plants operating at high load factor, there resulted a total of 350,000,000 kw.-hr. at 0.5 cent, making $1,750,000 which could have been saved or earned during the present year by interconnection and efficient use of existing plants, without considering the Niagara, St. Lawrence and metropolitan groups. This amount capitalized at 10 per cent would justify an investment of $17,500,000. Saving in coal would amount to 137,000 tons, which, at $6 per ton delivered, would be $822,000. This was based on the estimate that an average of 2¾ lb. of coal is consumed per kilowatt-hour in these plants under present conditions.

On the basis of the capital released—$7,875,000, as shown—and capitalized operating savings of $17,500,000 an investment of $25,375,000 would be justified, while all the more important interconnections necessary to effect this saving could be made for less than half this amount, probably not more than $10,000,000.

The latest study, the committee said, showed a diversity in peaks in the up-state section of New York of approximately 29 per cent and a combined generating capacity greater than the simultaneous peak by 63 per cent. This figure of 63 per cent, however, included a large amount of steam equipment installed to carry the load during low-water periods, and it did not represent correctly the capacity which would be available for interconnected loads during the low-water periods.

The steam stations in the metropolitan district, the committee went on, have a large reserve capacity, except during their lighting peaks. This excess capacity could be made available to other companies in the state for the greater part of the time that the up-state companies require steam capacity. The low-water period in the hydro-electric plants does not normally come at the time of the year when the metropolitan lighting peak is on, and even at the season of the metropolitan peak the actual duration of the peak load is not a large proportion of the total time. Therefore the metropolitan steam stations could supply a very appreciable part of the steam power requirements of the up-state companies. By means of load displacement in the interconnected system very appreciable amounts of power may be transmitted over long distances without excessive loss. This plan of operation would permit the metropolitan companies to dispose of off-peak energy and would give an improved load factor. Owing to the high economy of these steam stations, a large saving in total cost would be made.

Requisites of Operating Agreements

In order to obtain all of the advantages of interconnection as previously outlined, it is necessary that the flow of power be determined almost entirely by the physical requirements and the available sources of power. Operating agreements between different companies should be such that these agreements would not prevent the operating departments from obtaining power freely from other companies when required for load or to obtain economies. One

way of accomplishing this, as has been done in some instances, is by making agreements covering interconnections and exchange of power in which the charges for energy are such that the delivering company neither makes nor loses any money by the transaction.

The committee recommended that future towers and substations be erected to accommodate lines operated at 132,000 volts, the initial installation to be insulated for and operated at a lower voltage of either 66,000 or 110,000, which will take care of the requirements in the near future; that 60 cycles be adopted as a standard frequency for future construction, and that systems operating at other frequencies change to 60 cycles if or when the change is practicable.

Savings Banks and Utilities

The sentiments of savings banks toward the purchase of utility securities were voiced by George E. Stevenson of Hartford, Conn. He said that savings bank officials were coming to realize that they must not only protect the capital intrusted to them but also help build up the communities in which they reside. He could see no serious legal obstacles preventing savings banks from buying utility securities. M. S. Sloan urged all member companies to work in their respective communities to get savings banks to invest in gilt-edged utility securities.

A thoughtful and constructive address on hydro-electric development was given by O. C. Merrill, executive secretary Federal Power Commission. He accented the necessity for a national viewpoint in developing water-power resources and the necessity for formulating permanent state policies. He thought that the backwardness of New York in developing its water-power resources was due to the state not having any definite water-power policy.

On Tuesday H. O. Palmer reported for the accounting committee that the Public Service Commission would soon get out an order adopting the standardized classification of accounts and would give member companies the option of starting the new system on Jan. 1 of next year.

F. B. Steele reported for the advisory rate committee that demand rates had been studied but no definite conclusions reached. More than 147 different demand rates were found in use, with the greatest differences occurring in the width of the demand. The committee recommended the rural rate proposed by the rural rate committee.

J. O. Parker reported progress for the inductive co-ordination committee.

The New York State Committee on Public Utility Information, according to the report of the chairman, M. S. Sloan, is doing a very valuable work. Newspapers are using information compiled by the committee, the speakers' bureau is doing splendid work, and the industry advertising campaign has had a cordial reception.

"The Municipal Regulation Fallacy" was the subject of an able address by Carl D. Jackson. He said this question was settled in all states excepting New York and that New York needed to know all the facts about the utility business in order to prevent local regulation being established. He dwelt on the discriminatory rates that would result from local control, asserting that the opponents of state regulation were local politicians, those who wanted government ownership and those who advocated socialism and communism.

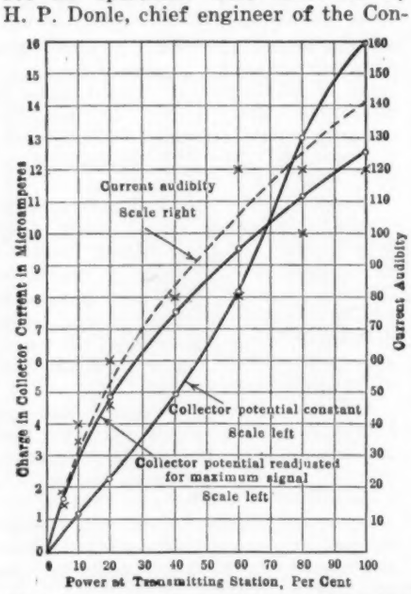
Dr. Murray Bartlett, president Hobart College, gave an inspiring address on the psychology of leadership and enumerated the moral and mental qualities necessary to real leaders.

Officers elected for the next year were: President, S. J. McGee, Ithaca; first vice-president, M. S. Sloan; second vice-president, E. G. Scobell. The executive committee will be M. J. Brayton, F. W. Smith, H. L. Mann and H. M. Brundage. Next year's meeting will be held on Monday and Tuesday in the first week in October at Lake Placid.

Progress in Wireless

New Applications of "Sodion" Radio-Detector Tube Are Described Before Radio Institute

APPLICATIONS of the new type of radio-detector tube which depends upon the ionization of metallic atoms for its operation were described by H. P. Donle, chief engineer of the Connecticut Telephone & Electric Company, Meriden, Conn., before the Institute of Radio Engineers in New York City on Wednesday of this week. The operating characteristics of this tube are very similar to those of the tube described by Mr. Donle last December (see ELECTRICAL WORLD for Dec. 23, 1922, page 1406). The present form differs in that no liquid sodium electrode is used. The outstanding features claimed for the "sodion" tube, as it is called, are high sensitiveness (about two stages greater than the hard-grid tube detector), pure quality of tone reproduction, stability in operation and absence of all interference-producing squeals and whistles as the tube cannot be made to oscillate or regenerate in itself.



NEW RADIO TUBE SHOULD PROVE INVALUABLE FOR MEASURING AUDIBILITY OF WEAK SIGNALS

Like the previous type, this tube has no grid but utilizes a tough-shaped piece of nickel, partially surrounding the filament and open toward the anode, as its control electrode. A glass shell contains the anode or plate, the filament and the collutor or control electrode. A heater is wrapped non-magnetically around the outside of the tube and a second external glass shell is placed over all elements for protection and to conserve heat. The tube is pumped to the highest possible vacuum and internally treated with an alkali metal (sodium) to provide the stable ionizing material that plays an important part in its sensitiveness.

The characteristic curves—anode current and collector-circuit current with the anode circuit opened and with it closed—are very similar to the curves shown in the article referred to above. When the potentials are properly adjusted the currents build up automatically to an equilibrium value fixed by the voltage applied to the collector. This building up is composed of a number of successive increases of current in the collector and anode circuits and reaches its delicate balance point after a time which is long as compared with a radio-frequency period. Any sustained radio-electromotive force applied to the collector circuit produces a marked and yet proportional drop in the equilibrium current, causing a signal in the telephone.

Change in Current Proportional to Audibility

This proportional drop in collector current is shown in the accompanying illustration, which shows the amount of current change produced by the reception of a uniformly modulated wave at varying intensities. The lower curve was taken without readjustment of the detector, and its general inferiority to the other solid line indicates the advisability of choosing the best collector potential for varying signal intensities. A comparison of the upper solid line with the dotted line brings out the interesting fact that the change in current produced by an incoming signal is proportional to its audibility. It is clear that the tube thus gives an apparatus for reading audibility of weak signals directly from a meter. The scattering of observed points of the dotted line, shown by the crosses, is characteristic of the ordinary audibility measurements, while the way in which the points lie directly on the other curves shows the high accuracy of the new method. Thus, aside from its radio receiving application, the tube should prove of great value in the laboratory for measuring very small currents.

The relation of input radio-frequency and output audio-frequency power for the tube is a straight-line ratio, which is a desirable relation for reproduction of high-quality reception.

A. E. R. A. Attracts 4,000

Commissioners from Five States Address Big Convention Held at Atlantic City

WITH more than four thousand in attendance at Atlantic City from Monday to Friday of this week, the American Electric Railway Association held a most successful convention, with a larger space devoted to exhibits than at any previous gathering. Assurance that the railways have really weathered their financial storm and that they are satisfactorily finding a solution to the bus problem by using the bus as an auxiliary was apparent from the discussion. Much of the post-war "shake-down" period is over and the future looks brighter.

These ideas were verified specifically by President C. D. Emmons in his address. He also spoke of how Detroit with its municipally owned railway had been unable to operate at a profit at low rates and was now in the same position as privately owned railways, namely, forced to higher fares by higher costs. As to the association's policy regarding municipal ownership, the railways, he said, are not afraid of losing property or profits, because many railways had had no profit for years.

President L. C. Datz of the Engineering Association made a plea against duplication of work by various engineering associations working independently on allied subjects. He urged greater support of the American Engineering Standards Committee, which, he said, is proving a powerful agency in encouraging associations to co-operate.

The valuation committee presented a long and carefully prepared report. It was directed principally toward finding means of valuation which will make unnecessary repeated inquisitions. In a sense this report indicated somewhat of a breaking away from the association's previous insistent stand on present-day-price reproduction cost and a tendency toward a stabilized valuation on some more substantial basis.

COMMISSIONERS GIVE VIEWS

At Wednesday's session five public service commissioners spoke. While addressing themselves primarily to the railroad and bus regulation problem, they all discussed commission practice and the record of regulation, and all made a plea that public opinion and utility opinion should regard commission work with sufficient respect to encourage men of ability, courage and knowledge to become commissioners. Courts can never adequately handle extra-legal economic problems with full satisfaction. Commissions must not seek to be courts and must not try to manage, but must regulate with wisdom and judgment. Some of the difficulties of regulation under inadequate laws which give only partial jurisdiction were also outlined, and the statement was made that most successful utility operation is had under full regulation with a competent board, allowing a fair return which will attract the necessary capital to allow the utility to expand.

Britton I. Budd, president of the Chicago, North Shore & Milwaukee Railroad, the Chicago Elevated Railways and the Public Service Company of Northern Illinois, was elected president of the association for the coming year.

Farm Electric Conference in Washington

A conference on electricity on the farm is to be held in Washington on Oct. 17 at which virtually all agencies interested in the problem of the relation of electricity to agriculture and the widespread development of rural electric service will be represented. The Secretary of Agriculture, the Secretary of Commerce and the Secretary of the Interior will be present at the conference, as will also the members of the joint committee on the relation of electricity to agriculture which represents the National Electric Light Association, the Farm Bureau Federation, the Department of Agriculture and the Society of Agricultural Engineers. The names of the members of this committee were printed in the ELECTRICAL WORLD for Sept. 15, page 553.

The purpose of next week's meeting is to acquaint the government officials with the research program to be carried out jointly for the benefit of the farmer. It will be recalled that the joint committee has already secured the services of E. A. White, who will be stationed at Chicago, to help work out a program of research looking toward an adequate solution of the problem of electricity supply to the farms. Next week's conference, in line with that program, will be directed toward bringing all agencies interested to co-operate to a common purpose.

San Francisco Companies Will Not Sell City Systems

President W. E. Creed of the Pacific Gas & Electric Company, replying to former Senator Phelan, who is chairman of the committee appointed by the city authorities to sound the local power companies with regard to the sale of their San Francisco distribution systems to the city for the purpose of marketing Hetch Hetchy power, has asserted positively that the company considers its San Francisco system an integral part of its whole power system and will not sell to the city. The Great Western Power Company has also refused to sell its San Francisco properties and the only recourse now left to the city is litigation or the financing of a new distribution system at an estimated cost of $45,000,000.

Appliance Distribution Methods a "Joke"

John F. Gilchrist So Characterizes Them at Washington Meeting of Electragists—General Squier Predicts Universal Radio Through "Wired Wireless"

DECLARING that somebody has got to "get up nerve enough" to tell the industry that the results derived from present methods of distributing electrical appliances are a "joke," John F. Gilchrist, vice-president of the Commonwealth Edison Company, Chicago, discussed merchandising policies with exceeding frankness before the twenty-third annual convention of the Association of Electragists International this week at the Hotel Washington, Washington, D. C. Mr. Gilchrist estimated that very conservatively it should be possible to sell $700 worth of appliances to the average residence consumer now on the central-station lines. The fact that companies that are doing the best selling today are only "edging in" at the rate of $10 a year means that it will be seventy years on the present basis before these homes will be equipped to this extent. Meanwhile houses are being built faster than electrical men are appliancing them and new appliances are being devised that broaden the line. Something must be done, Mr. Gilchrist said, to put the merchandising business on its feet, for at the present time those who are pushing it most energetically seem to be losing the most money. Central-station companies must continue to sell appliances, he believed, and to carry forward the work of pioneering, but they must maintain policies that will help build up the prosperity of the contractor-dealer and establish the widest possible local distribution.

The feature of the opening session of the convention was an address by General George O. Squier, Chief Signal Officer, U. S. A., on the subject of "Wired Wireless." General Squier predicted small compact radio sets as convenient and portable as a telephone in universal household use and described the opportunities for "wired-wireless" broadcasting service.

Miss Sarah M. Sheridan, vice-president Detroit Edison Company, presented an extremely interesting analysis of the work of women in the industry. About seven hundred women have come under her observation, and the records show an average business life of five years as compared with thirty-five years for men. This seven-to-one ratio reduces woman's chance to attain to executive positions. Femininity, she believes, itself is no disqualification, for all good feminine qualities win recognition and women qualify not as women but as workers and compensation should be based on service and responsibility.

An excellent program embracing two debates, one on the question of combining the contracting and merchandising businesses, and the other on a resolution declaring for higher quality in construction, was still in process at the time of going to press.

Institute Meetings in 1924

Midwinter in Philadelphia, Spring in Birmingham and Annual in Evanston

PHILADELPHIA has been chosen as the place for holding the midwinter convention of the American Institute of Electrical Engineers, which will take place on Feb. 4 to Feb. 8, 1924. The subject of railroad electrification will be emphasized, and it is planned that two sessions will be devoted to reviewing the present status of electrification and prospective plans for electrification as outlined by some of the foremost railroad men in the country. A feature promising special interest will be a celebration of the fortieth anniversary of the Institute. Reminiscences of the early days of the association will be given by founder members.

Plans are being made to hold the spring convention in Birmingham, Ala., during the week of April 7. Hydroelectric development and steel-mill and mining applications of electricity will be the topics.

Evanston, Ill., has been recommended as the meeting place for the annual convention, which will be held during the last week in June. The program has yet to be arranged.

Seek Lower Insurance Rates on Electric Trucks

During a luncheon of the Electric Motor Truck Club in New York City recently, H. P. Hood of the Edison Electric Illuminating Company of Boston told of the efforts being made by the insurance committee of the N. E. L. A. and the Electric Motor Truck Manufacturers' Association to have the fire insurance rate on electric vehicles reduced to the point where it will be the same as that on the buildings housing the cars. On the subject of insurance against theft Mr. Hood stated: "Experience has demonstrated that electric trucks are almost never stolen. If they are driven away by thieves, the contents are removed and the truck is generally recovered uninjured a few blocks from the scene of the theft. Reductions affecting a total yearly saving of $400,000, I believe, have already been granted, and we are convinced that further reductions in insurance rates for fire, collision and theft are in order."

Southern Power Cannot Build Unless Rates Go Up

The Southern Power Company cannot continue its building program under the present conditions, high costs of building material, equipment and labor, unless it receives a higher rate for its product. This was the substance of a talk made on Oct. 5 by W. S. Lee, vice-president of the Southern Power Company, before the Civitan Club of Charlotte, N. C. Mr. Lee declared that unless the Corporation Commission of North Carolina, composed of three men who, he said, "are the people's representatives on the board of directors of the Southern Power Company," allows the raising of the rates 10 per cent, it will be impossible for the power company to plan any further developments in that section. He declared that under present building costs the company could not pay dividends on new plants at the prevailing rate for power, and since it could not pay dividends it could not get the capital to finance new projects.

The State Corporation Commission took over the fixing of power rates two years ago. At that time the power company asked for a rate 20 per cent higher than the rate finally allowed, but accepted the rate as fixed.

Ontario Commission Accepts Cramp Turbines

The three high-capacity turbines built by the William Cramp & Sons Ship & Engine Building Company for the Hydro-Electric Power Commission of Ontario and just installed in the new Queenston-Chippawa station at Niagara Falls, Ontario, have been accepted by the commission after a test which showed a peak efficiency of 93.3 per cent and a very high average efficiency. These turbines are rated at 55,000 hp. each and operate under a head of 305 ft. The Cramp company is also installing in the plant of the Niagara Falls Power Company on the American side one 70,000-hp. turbine and is completing in its Philadelphia shops a second unit.

To the Pelton Water Wheel Company, which is owned by the Cramp company and has a manufacturing plant in San Francisco, a contract has just been awarded by the Pacific Gas & Electric Company for three 33,000-hp. vertical turbines for its Pit River No. 3 development, to operate under a head of 294 ft.

Governor Scrugham's Views on Colorado River Dispute

In a recent speech at San Francisco Gov. James G. Scrugham of Nevada, who is an engineer, said that pressure should be brought to bear upon the government for the creation of a Colorado River Basin power authority, having the same scope and power as the Port of New York authority which enables New York and New Jersey to expend federal appropriations for harbor and waterway improvements. This, he asserted, would preclude controversy between agriculture and commerce over priority rights and would automatically place all differences of great moment, such as the possible granting of power rights to Mexico, before the State Department at Washington.

In touching upon the site for the necessary dam between the upper and lower basins, Governor Scrugham said that neither the Boulder Canyon nor the Glenn Canyon site was satisfactory, according to recent tests made by geologists, but that drill holes in the Black Canyon, 300 miles from Los Angeles, had proved 100 per cent perfect. Here, he advised, engineers should study the problem of foundation with the view of erecting the dam when the pact has finally been ratified.

Public Utilities Representatives Discuss Safety

Of chief interest to the representatives of electric light and power companies who attended the Public Utilities Section meetings at the twelfth annual congress of the National Safety Council at the Statler Hotel, Buffalo, last week, was the comprehensive report of a special committee on accident causes and remedies, which was presented by C. J. Rutland, safety engineer Texas Power & Light Company, Dallas. The report emphasized two vital remedies for application by individual companies. The first of these was the exhaustive investigation of an accident, including the determination of the fundamental cause, fixing the responsibility, promulgating new rules, and the executive backing which is often essential and which carries great weight. The second was the accentuation of the foreman's responsibility, the scope of which, the committee held, might include the entire field of training the workmen and getting help in safety measures from them, the anticipation of accidents on the job, the issuing of special instructions for varying conditions and the enforcement of the rules in effect. Discussion on the report was led by H. W. Moses of the Edison Electric Illuminating Company of Boston and Harry Lucas of the Philadelphia Electric Company.

Attention was called to the rapid increase in radio accidents in a paper by H. J. Burton of the Consumers' Power Company, Jackson, Mich. He pointed to the dangers attending the use of the radio, particularly in the case of children, and explained what steps can be taken to eliminate these hazards. During discussion on this paper use of the indoor aërial was recommended as an important factor in reducing accidents.

J. A. P. Crisfield of the United Gas Improvement Contracting Company, Philadelphia, declared that 60 per cent of accidents during construction of plants are due directly to the man injured, 10 per cent are the fault of fellow-workmen and only one-half of 1 per cent are the fault of the employer.

Methods for eliminating the automobile hazard in connection with electric railway operation were discussed at the joint meetings of the Public Utilities Section and Electric Railway Section. James P. Barnes, president of the Louisville Railway Company, recommended more rigid enforcement of motor-vehicle laws.

These were elected officers of the Public Utilities Section: Chairman, H. W. Moses, Edison Electric Illuminating Company of Boston; vice-chairman, B. B. McCulloch, Bureau of Safety, Chicago; secretary, George Opp, Detroit Edison Company.

Supervisory Control

Representatives of Three Big Manufacturing Companies Tell of Its Development

UNUSUAL interest was excited at the meeting of the Connecticut Section, A. I. E. E., in New Haven on Oct. 4 by the discussion of "Supervisory Control"—particularly for power systems. The meeting was held in the Dunham Laboratory of Yale University, and the General Electric Company, Westinghouse Electric & Manufacturing Company and Western Electric Company had set up energized systems for demonstration purposes. The equipment was shown in operation by the speakers during their talks and afterward. C. E. Stewart described the General Electric Company's equipment and was followed by F. Zogbaum, who explained the functioning of the Western Electric Company's equipment, which is co-ordinated with that of the General Electric Company. The former described in detail the functioning of each portion of the equipment along the general lines of his joint article with J. C. Field appearing in the ELECTRICAL WORLD for Sept. 29, page 655 The safeguards that are provided to avoid failures and to insure intelligent functioning in case of failure were covered in the talk. The speaker showed slides exhibiting other types of equipment that had been developed for somewhat different forms of application. Mr. Zogbaum pointed out the fundamental principles of the mechanism and in general showed how the "start-stop" printing-telegraph device had been employed as a foundation for the supervisory control development. He also showed slides exhibiting structural and assembly features of this and other types of equipment.

WESTINGHOUSE EQUIPMENT

R. J. Wensley, representative of the Westinghouse Electric & Manufacturing Company, then described that company's type of equipment. He began by outlining the need created for such equipment by labor and economic situations arising first in connection with the ordinary attended substation and then later with the unattended substation. In the early stages automatic equipment had been more or less limited to the performance of a "canned" program. Occasionally it became necessary to vary that predetermined program, but it could only be done by motorcycle messenger or some similar means. The development of supervisory control has provided means of obtaining information which formerly only a messenger could get. It has proved economically feasible and partly so by reducing to a minimum losses incurred through mistaken operation of switches and similar equipment. The Westinghouse equipment is based upon automatic telephone mechanism, and in fact whole units exist exclusively of standardized machine switching relays, contacts, coils etc.

The electrical message consists in all cases of twenty-five line impulses, the code being obtained by the variation in location of two pauses in the sequence of these impulses. At the receiving end a scheme similar to the Clement selection principle is employed. This consists of a labyrinthine way of arranging devices so that only one electrical path is provided through them on receipt by the relays of the impulses and pauses. The speaker pointed out how the mechanism is safeguarded against failure and some of the supplementary functions that can be performed by this equipment.

When asked by the audience to give some indication of cost of such a system, Mr. Wensley said that costs vary considerably, but a system adequate for ten circuit breakers would cost slightly more or less than $2,000. He also mentioned a "flivver" set, as he described it, designed for small hydro-electric developments, which costs in the vicinity of $400.

Many of the one hundred in attendance were men in responsible charge of power systems, and the discussion became unusually active after Chester Lichtenberg of the General Electric Company's staff had pointed out that supervisory control really dated back to a more or less primitive system adopted by the New York Edison Company in 1902 and materially improved by that company about 1912. It was not until 1920 that Chambers of the Des Moines Railway urged the perfection of an adequate supervisory system, thus giving an impetus to the development.

Arizona Promotes Plan for 750,000-Hp. Development

Application for water and power from the Colorado River for the irrigation of 3,500,000 acres of land in Arizona has just been made in filings with the State Water Commissioner by the Arizona Highline Reclamation Association. The filings were based on the United States Supreme Court decision in the Colorado-Wyoming case, which, according to State Senator F. T. Colter, president of the association, "substantiated as between states the long-used, satisfactory and tested law of prior appropriations that has been established in almost all of the Western irrigation states."

The plan provides for tunnels through several mountains and flumes across rivers and the cost is put by an engineering committee at $280,000,000. While the power possible of development is said to be in excess of 1,000,000 hp., it is deemed advisable to recommend only the development of 750,000 hp. as a part of the initial construction. Assuming, the committee says, that this will be used for all commercial purposes as well as household use, and that it will be sold at not more than 1¼ cents per kilowatt-hour, the net earning from the power, if financed on a 4½ per cent basis, will pay off a construction bond issue of $340,000,000 in forty years.

Brief News Notes

Farmington, Iowa, to Sell Municipal Plant.—Voters of Farmington, Iowa, have authorized the sale of the municipal light plant to the Iowa Electric Company of Cedar Rapids.

Buffalo Electrified Foundry Exhibit Made Six or Seven Heats a Day.—In the news report of the convention of the Association of Iron and Steel Electrical Engineers at Buffalo, on page 672 of the Sept. 29 issue, an error was made in stating that two heats a day were made in the electrified foundry exhibit. The minimum number of heats produced by the electric furnace per day was six, the maximum number was seven.

Adirondack Company Expanding.—Improvements and extensions at its South Amsterdam generating plant to cost in the neighborhood of $3,000,000 have been approved by the board of directors of the Adirondack Power & Light Company. An additional steam turbine unit of 40,000 hp. is to be delivered in the spring. To accommodate it the Mohawk River power house is to be doubled. The new unit will bring the production of the Amsterdam plant of the company up to 80,000 hp.

Norman and Enid Renew Oklahoma Gas & Electric Company Franchises.—Citizens of Norman and Enid, Okla., have voted by large majorities to grant new twenty-five-year franchises to the Oklahoma Gas & Electric Company. In Norman, to which the company has been furnishing electricity for about nine years, the vote was 1,236 to 289, and in Enid, a city of 21,000 population, which has been supplied with electric light and power by the Oklahoma Gas & Electric Company and its predecessors for about twenty years, the vote was 1,269 to 533.

Relations of Trade Associations and the Federal Government.—This will be the subject of an address to be made by W. J. Durgin of the United States Department of Commerce at Providence, R. I., on Oct. 18, before a convention of the American Bottlers of Carbonated Beverages. Mr. Durgin is in charge of the government's program to standardize manufactured products in the United States and has presided at the conferences held by the various industries at the call of Secretary of Commerce Hoover. He will attend this convention as the personal representative of the Secretary.

Increased Voltage Benefits Seven Towns.—The Southern Minnesota Gas & Electric Company, which serves many northern Iowa towns with electrical energy, has just completed the work of raising the voltage on its main trans-

mission line between Winnebago and Elmore, Minn., from 13,000 to 23,000. This will materially improve the service in the towns of Ledyard, Lakota, Swea City, Bancroft, Titonka, Buffalo Center and Thompson, Iowa. A division office has been opened at Winnebago to bring the company closer in touch with the Iowa towns which it serves.

Electric Transportation News Bulletin.—The Electric Transportation Bureau of the N. E. L. A. has issued the first of a series of semi-monthly news letters on the progress of electric trucking. It directs attention to the importance of electric truck shows, specifying the one to be held as part of the New York Electrical and Industrial Exposition on Oct. 17-27, and to the advantages of electric vehicles in laundry collection and delivery service.

Radio Links Poland and United States.—The United States and Poland were brought into direct communication on Oct. 4 when officials of the Radio Corporation of America and the Polish government exchanged greetings by means of a commercial radio service inaugurated on that day. The completion of work on this circuit, which was undertaken by the Radio Corporation of America for the Polish government in August, 1921, further advances plans to make the United States the center of a world-wide radio communication system. The cost of the New York and Poland stations is placed at $2,000,000 and the work has been in progress nearly two years.

National Organizations Co-operate for Management Week.—Over a score of meetings for spreading the ideals of better management will be held in different parts of the United States during the week of Oct. 22 or near that time. Programs for these have been arranged under the direction of representatives of the American Society of Mechanical Engineers, the Taylor Society, the Society of Industrial Engineers, the American Management Association and the National Association of Cost Accountants, who are co-operating in this second observance of Management Week, which was instituted by the A. S. M. E. in 1922.

Low Water in Maine Hampers Production of Electricity.—Water in the Saco River in Maine is reported lower than it has been for some years at this season of the year. Only 500 sec.-ft. was on a recent date passing over the West Buxton dam, where the volume of water has sometimes ranged as high as 2,470 sec.-ft. Because of the low water the Cumberland County Power & Light Company has been obliged to substitute steam-manufactured power for water power to a large extent. Many small mills along the upper reaches of the Saco have been forced to close down temporarily, and hotels and residences which generally depend upon water power for the manufacture of their electricity have in some cases been driven to substitute some other form of lighting.

Federal Question Enters Grand River Situation.—The relation of the federal government to the proposal of the Grand River Hydro-Electric Company to construct three dams across the Grand River in Mayes and Wagoner Counties, Okla., may delay permission from the state engineer to construct these dams. The question hinges upon whether the United States government has ever included the Grand River in Oklahoma among navigable streams. The application of the Grand River Hydro-Electric Company calls for two dams 35 ft. high and one dam 30 ft. high, each to cost approximately $1,500,000. The applicants are prepared to finance the project and complete it within five years. Electrical energy totaling 100,000,000 kw.-hr. per year will be developed from each dam. No formal objection to the application has been filed.

South Carolina Utility Companies Contest Tax.—Contending that electric light and power and gas companies are "public utilities" and not "manufacturers" and accordingly have been illegally required to pay the manufacturers' tax levied by the State Tax Commission, the Columbia (S. C.) Railway, Gas & Electric Company has instituted suit against the State Tax Commission to recover the taxes paid under the act of one-tenth of 1 per cent upon their gross receipts. As a test case the suit will affect all manufacturers of gas and electricity in the state. The company's contention is that it is a "public utility," as defined in the act creating the enlarged State Railroad Commission, and not a "manufacturer." This distinction, it is claimed, has heretofore been recognized by the state taxing bodies and by the General Assembly itself.

Seven-Hundred-Mile Interconnection About Completed.—With the testing of the 60,000-volt transmission line between Centerville, S. D., and Hartington, Neb., one of the final steps was taken to form a 700-mile arc of high-tension line reaching from Eau Claire and Chippewa Falls in Wisconsin westward and southward through Minneapolis and St. Paul, Sioux Falls, S. D., and Sioux City, Iowa, to Omaha. The plan to connect up the power lines of different companies has been worked out to equalize the distribution of electric power through the northern section of the Middle West. The Centerville-Hartington line was built by the Minnesota Electric Distributing Company, and the 700-mile line is the result of co-operation between this company, the Tri-State Utilities Company, the Northern States Power Company, the Sioux City Gas & Electric Company and several other electric light and power concerns.

Associations and Societies

Charleston Electrical Contractors and Dealers' Association.—This body has prepared an electric show to be held at Charleston, S. C., Oct. 15 and 16. A number of displays by local concerns and nationally known fixture and equipment houses have been entered. T. A. Brookbanks is president of the association and J. P. Connelly secretary and treasurer.

Southern A. S. M. E. Men to Discuss Topics of Electrical Interest.—At the first regional meeting of the American Society of Mechanical Engineers to be held in the South, which will meet in Chattanooga, Tenn., on Oct. 23 and 24, R. D. Reed of the General Electric Company will discuss arc welding, J. A. Switzer and W. R. Woolrich the power development of the Southern Appalachian slope, and R. H. Lowndes the use of pulverized fuel as applied to the open-hearth furnace in small power plants.

Northwest Electric Light and Power Association.—The following executive committee chairmen have been appointed by President George L. Myers of the Northwest Electric Light & Power Association: Technical Section, John B. Fisken, Washington Water Power Company; Commercial Section, W. M. Shepard, California Oregon Power Company; Accounting Section, George F. Nevins, Pacific Power & Light Company; Public Relations Sections, Norwood W. Brockett, Puget Sound Power & Light Company. A. T. Schultz, vice-president of the Helena Light & Railway Company, has been named vice-president for Montana.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56 for latest list.]

West Virginia-Kentucky Association of Mine, Mechanical and Electrical Engineers—Frederick Hotel, Huntington, W. Va., Oct. 19-20. Herbert Smith, Robson-Prichard Bldg., Huntington.

Telephone Pioneers of America—Atlantic City, N. J., Oct. 19-20.

Arkansas Utilities Association, Pine Bluff, Nov. 15-16.

Electric Power Club—French Lick Springs, Ind., Nov. 19-22. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

Southeastern Division, N. E. L. A.—Tampa, Fla., Nov. 19-22. Charles A. Collier, Georgia Railway & Power Company, Atlanta, Ga.

American Society of Mechanical Engineers—New York City, Dec. 3-6. C. W. Rice, 29 West 39th St., New York.

National Association of Railway and Utilities Commissioners—Miami, Fla., Dec. 4-7. J. B. Walker, New York Transit Commission, New York City.

American Institute of Electrical Engineers—Midwinter convention, Philadelphia, Feb. 4-8. F. L. Hutchinson, 33 West 39th St., New York.

Recent Court Decisions

Powers of Ohio Commission.—In Village of New Boston vs. Public Utilities Commission, the Supreme Court of Ohio has ruled that the inclusion in a contract adopted before the jurisdiction of the commission was established of a clause reading, "And to be thereafter subject to the provisions of the statutes in the State of Ohio in such case made and provided," did not reserve to the village the right to act in accordance with the statutes as they existed when the municipal ordinance was adopted. Gas rates prescribed by the commission, which are higher than those set in a new ordinance, were sustained by the court. (140 N. E. 607.)*

To Be "Unjust and Unreasonable" a Rate Need Not Be Confiscatory.—Affirming the legality of gas rates fixed for the city of Portsmouth by the Ohio Public Utilities Commission, suit having been brought by the former against the latter because the rates set by city ordinance were increased on complaint of the gas company, the Supreme Court of Ohio said: "It is the contention of the plaintiffs in error that if the rate fixed by the ordinance was not confiscatory, it then follows that the same was reasonable and just, the question being not what rate the commission might have made in the premises had it had the authority to fix the same in the first place, but, is the rate established by the council in its ordinance a confiscatory rate? We think there must be a clear line of demarcation between a rate that is confiscatory in character and one that must be fair and reasonable. It is not sufficient to say that because a rate is not confiscatory in character it must necessarily follow that it is fair and reasonable and just to both parties." (140 N. E. 604.)

Valuation of Utility Property by Commission Does Not Create Contract Impaired by Revaluation.—The United States District Court in Alabama has decreed, in Mobile Gas Company vs. Patterson, that under the public utility act giving the Public Service Commission power to fix rates for public utilities, and providing that it shall, after investigation, fix a valuation on the property of a utility which shall for all future rate-making purposes be the permanent basic valuation, and which valuation, if made at the request of a utility, shall be at its expense, such a valuation, made at the request of a gas company and for which it paid, did not create a contract between the company and the state which was impaired by an amendatory act authorizing a revaluation. While thus determining the right of the commission to proceed with a second valuation, the court sustained the company in its contention that a second examination of its books and records a few months after the original one would be an "unreasonable search" in violation of the state constitution. (290 Fed. 476.)

City Tax on Wires and Poles a License Fee. — The Delaware Supreme Court has supported the contention of the tax collector of the city of Wilmington that a statute which provided for the assessment of all electric power, street railway, telephone or telegraph poles and wires on public streets according to a certain rate on every $100 of their estimated value imposed merely a license fee for the privilege of using streets. In New York, Philadelphia & Norfolk Telegraph Company vs. Dolan the plaintiff contended that the assessment was a real estate tax and unconstitutional because no opportunity was given to the taxpayer for a hearing, and also that the tax was arbitrary and confiscatory. (128 At. 18.)

Doctrine of "Res Ipsa Loquitur" Does Not Apply Where "Act of God" Is Set Up by Defense. — During an extraordinarily severe storm in Toledo, Ohio, poles and electric wires belonging to the Toledo Railways & Light Company fell upon an automobile wherein one Loomis was riding, injuring him. He thereupon brought suit against the company, alleging that the poles were rotten and of insufficient strength and also setting up the doctrine of *res ipsa loquitur* (the thing speaks for itself). The Supreme Court of Ohio has upheld a verdict for the defendant, finding that, the storm being an "act of God," the doctrine invoked did not apply and the jury had the duty of deciding whether the defendant was negligent in maintaining the poles and wires as alleged or whether their falling was the result of a happening beyond the company's control. Its verdict must stand. (140 N. E. 639.)

Priority of Claim to Hiawassee Power Rights Sustained.—The Supreme Court of North Carolina has just sustained the claims of the Carolina-Tennessee Power Company to power rights on the Hiawassee River, in western North Carolina, against the contentions of the Hiawassee River Power Company. The case, which is of several years' standing, involved the titles to certain parcels of land along the river. The lower court awarded these lands to the Carolina-Tennessee company because of priority of claim, and the Supreme Court sustains this decision. The lands involved are in the possession of the Hiawassee company and the successful litigant must pay the loser the amount involved. The Hiawassee company resisted the claims of the Carolina-Tennessee company on the ground that it had lost its rights by reason of the statute of limitations, but an effort to have the Legislature revoke the latter company's charter failed. The charter question, however, will finally be decided by the Federal Supreme Court. The plaintiff claims that the special charter granted the Carolina-Tennessee company is in violation of the Fourteenth Amendment to the United States Constitution, and appeal already has been made to the federal court on this and other grounds.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Municipalities Must Obey Wisconsin Electrical Code.—Finding that the city of Barron has violated the Wisconsin Electrical Code by carrying its wires through trees, insulation being destroyed, the trees damaged and hazards set up, the Wisconsin Railroad Commission has ordered that the city increase the height of its poles and wires by 10 ft. or else remove the wires to a location where they will not encounter trees. The city must not, however, in so doing, discontinue service to existing consumers.

Price to Be Paid for Utility Immaterial Until Question of Capitalization or Rates Is Raised.—In granting authority to the Sunapee Electric Light & Power Company to absorb the Bradford Light & Power Company, the New Hampshire Public Service Commission refused to concern itself about the price paid, saying: "The price to be paid for this property is not material as the purchaser is not asking to issue securities against the property purchased. If and when the question of capitalization or of rates is raised, it will be necessary for the commission to determine the fair value of the property."

Apportioning Cost of Rural Transmission Line.—A dispute between five rural customers of twelve years' standing and the Portland Railway, Light & Power Company concerning the reestablishment of service discontinued because of the action of a land owner over whose property the transmission lines were carried in disconnecting the supply wires came before the Public Service Commission of Oregon for adjudication. The company claimed that to resume service an old privately owned supply line would have to be abolished and a new standard distribution system built at an expense of $90 each to the complainants. The commission, holding that new business along the line would repay the company for any necessary reconstruction of the old private line, ordered an assessment on the five complainants of only $18.85 each on condition that they relinquish their equity in the private line to the company and execute an agreement to take continuous service for not less than one year.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

Samuel Insull, president of the Commonwealth Edison Company, Chicago, sailed from New York on Tuesday of this week for Europe for a short visit.

Clifford R. Beardsley, formerly electrical engineer with Fred L. Ley & Company of Springfield, Mass., is now superintendent of electrical construction for the Brooklyn Edison Company.

W. H. Cahoon, formerly associated with C. M. Read of Lansing, Mich., has recently associated himself with McClellan & Junkersfeld, consulting engineers of New York, as assistant electrical engineer.

W. M. States, formerly manager for the International General Electric Company, Shanghai, China, has been appointed assistant manager of the Edison Lamp Works of the General Electric Company, Chicago.

L. B. Breedlove has been appointed consulting engineer for the Chicago Trust Company to act in an advisory capacity for the analysis of public utility and industrial properties for the bond department of this company.

E. W. Oesterreich, formerly associated with William G. Woolfolk, consulting engineer of Chicago, is now connected with the Duquesne Light Company of Pittsburgh as superintendent of the underground cable division.

Ward H. Snook has joined the Snook-Hillhouse Company, consulting engineers, Columbus, Ohio, as president. Mr. Snook was previously inspector of power wires on the Public Utilities Commission of Ohio.

Sorab B. Damania, who was formerly construction engineer with the Andhra Valley Hydro-Electric Power Supply Company, Ltd., Bombay, India, is now engineer in charge of the Bombay Electrical Supply & Tramway Company's power house.

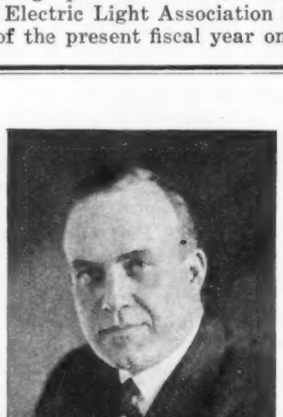
Robert B. Morton, recently associated with Tolz, King & Day, engineers, St. Paul, as electrical engineer in connection with the design and construction of a large steam-power plant, has severed his connection with that firm to become project engineer with Gibbs & Hill of New York.

Thomas M. Gibbes, formerly associated with the Appalachian Power Company, with operating territory in Virginia and West Virginia, has entered the sales department of the Puget Sound Power & Light Company. Mr. Gibbes is in charge of power sales.

F. R. Lack, an engineer of the International Western Electric Company, has had bestowed upon him by the Emperor of Japan the sixth class of the Imperial Order of the Rising Sun. The award is in recognition of his services in connection with the installation of the first printing telegraph in Japan. Mr. Lack has been associated with the Western Electric Company since 1911. His service with the company has been uninterrupted since except for a period spent in military service.

Norman Read President-Elect of Rocky Mountain Division

Norman Read, vice-president and general manager of the Colorado Power Company, has been elected to succeed to the presidency of the Rocky Mountain Geographic Division of the National Electric Light Association at the close of the present fiscal year on June 30, 1924. The election was held at the recent annual convention of the division in conjunction with the Colorado Public Service Association at Glenwood Springs, Col.



NORMAN READ

Although a native of England, Mr. Read received all his education in Colorado. He graduated from the University of Colorado as an electrical engineer in 1905, and the same year he entered the service of the old Denver Gas & Electric Company, where he remained for two years in the engineering department. For a short time he represented the Nernst Lamp Company in the Rocky Mountain territory. In 1908 he became a consulting engineer in Denver, specializing in hydraulic design and construction work, and he remained in an independent capacity until 1910, when he was appointed assistant superintendent of power of the Denver Tramway Company. Later, when serving as superintendent of power and electrical engineer for that company, he resigned to become assistant general manager in charge of operations of the Colorado Power Company. In November, 1916, he was elected to his present position of vice-president and general manager of the company.

Mr. Read is a past-president of the Colorado Public Service Association, past-chairman of the Denver Section of the A. I. E. E. and has served as vice-president of the Rocky Mountain Division of the N. E. L. A. for the last two years. He is now a member of the executive committee of the National Technical Section of that association.

W. L. Robinson, who has been assistant superintendent at Bath for the Central Maine Power Company for the last five years, has been transferred to Skowhegan as assistant district superintendent, succeeding the late Walter Wyman.

John R. Nichols, formerly chief engineer, Monks & Johnson, Boston, has opened a consulting engineering office in that city, where he will specialize in the design and construction of industrial plants and will handle miscellaneous problems in structural and construction engineering.

Col. William Kelly, chief engineer of the Federal Power Commission, is making a detailed inspection trip throughout the Rocky Mountain region. He expects to visit a number of projects. During the colonel's absence Major H. S. Bennion will act as chief engineer.

W. E. Douglass, who has been associated with the Westinghouse Electric & Manufacturing Company for ten years, recently severed his connection with that company to enter the service of the Wisconsin Valley Electric Company in the capacity of electrical engineer in charge of generating stations and transmission.

W. A. Lackaff, formerly district manager of the Pacific Power & Light Company at Toppenish, Wash., has been transferred to the head office at Portland, Ore., to succeed P. J. Kean as purchasing agent. G. L. Corey, formerly district manager at Seaside, Ore., has been selected to succeed Mr. Lackaff as manager of the Toppenish district. E. W. Rouleau is the new manager of the Seaside and Gearhart district.

Secor Cunningham, D. W. Roper and **B. G. Jamieson** of the Commonwealth Edison Company and **F. E. Goodenough** of the Public Service Company of Northern Illinois recently returned to this country from a four months' trip of inspection abroad. Samuel Insull, Jr., was one of the original party, which sailed from New York on May 19, but he was obliged to return home before the trip was completed. Ten different countries were visited, the trip covering more than 17,000 miles. It had for its object a study of European methods of generation and distribution of electricity with special reference to the use of high-tension cable, high-tension oil switches, rural uses for electricity and hydro-electric developments. As a result of this comprehensive journey three special reports are being prepared—on high-tension cable by Mr. Roper, on circuit breakers by Mr. Jamieson and on rural service by Mr. Insull.

A. L. Rohrer Retires

A. L. Rohrer, superintendent of light, heat and power at the Schenectady works of the General Electric Company, has retired after thirty-nine and one-half years' service with the company and is succeeded by O. A. Clark, who has been assistant superintendent since the department was organized in 1917. Mr. Rohrer entered the employ of the Thomson-Houston Company at Lynn early in 1884. When that company was merged into the General Electric Company in 1892 he went to Schenectady as technical adviser in charge of drafting and designing. In 1894 Mr. Rohrer was appointed electrical superintendent, and the following year, when G. E. Emmons became manager of the Schenectady works, Mr. Rohrer became one of his principal lieutenants. For twenty years he has been in charge of selecting college men for the General Electric test, and during this time he has visited nearly all the technical colleges and the universities of the country. Mr. Rohrer will remain with the company in an advisory capacity and will spend most of his time in Schenectady.

Mr. Clark, his successor, is a graduate of the University of Kansas, class of 1904. In 1905 he entered the General Electric Company's employ and in 1906 was transferred as assistant to the electrical superintendent, then Mr. Rohrer. In 1917, when the light, heat and power department was organized, Mr. Clark was made assistant superintendent.

E. Auger is now superintendent of district of the Minnesota Electric Light & Power Company, Bemidji, Minn., succeeding J. Cook.

L. Kreitinger is now president of the municipal electric light and water works at Springfield, Minn., succeeding H. Birkemeyer.

Charles Whitaker has succeeded A. Clark as engineer of power station of the municipal electric plant at Red Cloud, Neb.

E. B. Lamb, formerly associated with the Inland Steel Company, Indiana Harbor, Ind., is now associated with the Illinois Traction System in Peoria, Ill.

Joseph A. Brookman, formerly connected with the West Penn Power Company, Pittsburgh, is now associated with the Ohio Power Company at Steubenville.

Carl H. Hermance, who was formerly with the United Electric Light & Power Company, New York, is now with the Southern California Edison Company, Los Angeles.

William Ives has been placed in charge of the sub-office at Norfolk, Va., of the Westinghouse Electric & Manufacturing Company's Baltimore branch office.

Eugene Herzog, formerly connected with the test department of the United Electric Light & Power Company, New York, is now in the research department of the General Electric Company at Lynn, Mass.

R. E. Baird, general manager of the Oklahoma Gas & Electric Company at Poteau, has been transferred to Pauls Valley as general manager of that district. J. R. Werth, formerly commercial agent at Poteau, has been selected to succeed Mr. Baird.

Robert B. George, who has been recently connected with the Mississippi Agricultural and Mechanical College, has become professor of electrical engineering at the Oklahoma Agricultural and Mechanical College, Stillwater, Okla.

H. L. Moody has severed his connection with the Philadelphia office of the Westinghouse Electric & Manufacturing Company, where he was manager of the central-station division, to become associated with the U. G. I. Contracting Company, Philadelphia.

A. F. Torrey of New Haven, Conn., has recently been appointed new-business manager of the Trenton (Mo.) Gas & Electric Company, which property is under the management of the General Engineering & Management Corporation, New York.

Russell P. Wise, formerly assistant to the sales manager of the Simplex Electric Heating Company, Cambridge, Mass., has been appointed sales manager of the Spencer Thermostat Company, Cambridge. Mr. Wise assumed the duties of his new office Oct. 6.

L. W. Scott, manager of the municipal electric and water plant at Fairport, N. Y., for the past three years, has allied himself with the Hamburg (Pa.) Gas & Electric Company as assistant to the general superintendent. Mr. Scott was formerly district superintendent for the Empire Gas & Electric Company at Clyde, N. Y. He assumed his new duties Oct. 1.

W. L. Goodwin, assistant to the president of the Society for Electrical Development, and F. M. Feiker, formerly vice-president of the McGraw-Hill Company, Inc., who recently joined the staff of the society, were made operating vice-presidents of the society at a meeting of the executive committee held at staff headquarters.

T. L. Tynes, who for sixteen years has been electrical engineer for the Lackawanna Steel Company of Buffalo, now the Bethlehem Steel Company, has gone to the Buffalo plant of the American Radiator Company in the same capacity. For nine years before his connection with the Lackawanna company Mr. Tynes was erection engineer with the Westinghouse Electric & Manufacturing Company's Pittsburgh office.

Roy Worth, who has been associated with the Pacific States Electric Company, San Francisco, since 1914, was recently appointed assistant manager of the company. In 1914 Mr. Worth joined the sales force at Seattle, and since that time he has served as assistant treasurer, assistant district manager at Seattle, and for the past three and a half years as district manager of the Seattle branch. Mr. Worth has been in the electrical supply jobbing business for a number of years and has a wide circle of friends in the trade.

H. A. Rinker of Springfield, Ohio, has been named superintendent of the Marysville properties of the Ohio Edison Company.

N. B. Garden, formerly power engineer of the Ohio Power Company at Tiffin, Ohio, has been transferred to the engineering department of the company at Canton.

W. R. Ham, formerly connected with the engineering department of the Adirondack Power & Light Corporation, Amsterdam, N. Y., has been transferred to Saratoga Springs as electrical superintendent.

R. R. Jewell, formerly district superintendent of the Ohio Service Company at Newcomerstown, Ohio, has been transferred to New Philadelphia in the same capacity. J. W. Bodenheimer has succeeded Mr. Jewell at Newcomerstown.

C. E. Watson, formerly designing engineer with the G. & W. Electric Specialty Company, Chicago, is now in the electrical engineering department of the Duquesne Light Company.

J. L. Guthals has been appointed new-business manager of the San Angelo (Tex.) Water, Light & Power Company, succeeding R. A. Stroud, who has been transferred to the accounting department.

L. R. Jones, formerly research assistant at the Massachusetts Institute of Technology, has entered the transmission department of the Public Service Company of Northern Illinois in Chicago.

F. H. Ives, sales manager of the Adirondack Power & Light Corporation at Glens Falls, N. Y., has severed his connections with the company to become sales manager of the Service Appliance Company of that city. Mr. Ives was recently transferred to Glens Falls from the Schenectady office of the Adirondack company.

Obituary

Frederick C. Bates, for twenty-seven years employed by the General Electric Company, most of which time he was manager of the lighting department in the New York office, died Oct. 2 at his home in Brooklyn after a long illness. Mr. Bates, who was well known in the electric light industry, entered the employ of the Thomson-Houston Company, Lynn, Mass., in 1887 and was sent in 1894 to Berlin to supervise electrical installations with the Allgemeine Elektricitäts-Gesellschaft. He returned in 1896 and became connected with the New York office, where he was soon appointed manager of the lighting department. Mr. Bates was born in Danielson, Conn., in 1867. He was vice-president and treasurer of the Orange County Public Service Corporation and an officer in its affiliated companies. He was a member of the Machinery and Engineers' Clubs, New York, and a member of the A. I. E. E.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Work of Associated Lighting Industries

Some of the Reasoning Behind the "Notice the Lighting Equipment" Campaign and What It Means to the Industry at Large

By Herman Plaut
President of National Council Lighting Fixture Manufacturers

THERE are two aspects to the campaign of education now being conducted by the associated lighting industries throughout the country that it seems to me should have a particular interest to the electrical industry in general. This is the campaign which has been organized behind our slogan "Notice the lighting equipment." It is doing something very definite for the lighting-fixture people and it is contributing an influence of even greater benefit and value to the electrical industry at large.

Briefly speaking, the big problem before the lighting-equipment industry today is the lack of understanding on the part of the public in regard to the really vital importance of this equipment. People are considering it as something fixed and immutable like the laws of the Medes and Persians. Lighting fixtures handed down to them by their forefathers are apparently taken for granted and looked upon as unchangeable.

Will Promote Complete Equipment Idea

The word "fixture" itself has been an unfortunate selection. It seems to signify something immovable and people have accepted this interpretation. The result has been that the idea of refixturing a house has really never registered with the public. If extensive alterations and redecorations are in process, new fixtures naturally suggest themselves, but the average family never thinks of buying a better, more attractive and more artistic chandelier for the living room or library, although it would purchase a new rug or chair to take the place of an old one that was not satisfying without hesitation and as a matter of course.

All this of necessity means something to the electrical industry. It means first loss of business to the fixture manufacturer, jobber and dealer. It means also loss of work to the contractor who would be called upon to hang these fixtures or to install fixture receptacles, such as "elexits," as the homes of America adopt this new method of fixture attachment. But it will mean more than that to the industry at large. The mere effect of the establishing of this new mental attitude toward fixtures, the setting up of a receptive state of mind toward fixtures on the part of men and women generally, will inevitably influence their whole point of view toward electrical equipment. Light is the fundamental use of electricity in the household. Everybody looks on this today as the first necessity and the other applications follow. Ultimately we shall have complete electrical equipment in the average home.

It will come more quickly and more easily when people get away from the old idea that once the electric lights are in nothing more can be done about it. When we all of us begin to realize and accept in our household planning the fact that the lighting can be improved and made more convenient and enjoyable as time passes by, then will the spirit of getting the home equipped completely and in the most modern style take hold and the trick will be turned. The electrical industry will no longer have to fight to make people see that a house should be completely outfitted with electrical equipment any more than the hardware industry has to fight to make people see that a house should be completely equipped with hardware. They will do it as a matter of course, and the job will be then just one of selling quality as it is in the hardware field today.

The purpose of this campaign of ours is, of course, primarily to promote the sale of lighting equipment by making the public a little more "lighting-equipment conscious." But in reality the fixture associations will in the end be performing a far greater service to the electrical industry as a whole. And this is well.

We are all aware of the wonderful possibilities which modern lighting makes available for people in so many different ways, and we also know that the best effect of modern lighting cannot be obtained without proper lighting equipment. The problem before the industry as we see it is, therefore, to create a public consciousness of lighting equipment, make people realize what it can do for them and get them to "notice the lighting equipment." It was at the beginning of this year that the first announcement of this plan was brought to the attention of the entire industry. During the "Fixture Market" in January in Cleveland the publicity committee decided definitely upon a campaign built around this slogan, on which was to be expended not less than a hundred thousand dollars a year for at least three years. The financial canvass for raising this amount is making satisfactory progress but has not yet been completed.

Results of the Movement

In the meantime, however, the industry took hold of the idea spontaneously. Manufacturers and dealers started in to use the slogan and its use is very rapidly increasing in volume. We have at our office samples of printed matter and clippings from publications showing definitely that in the neighborhood of fifty million impressions of the slogan have already been made. This means that that many times people have already been called upon to "notice the lighting equipment." You will agree that this is a really remarkable showing for so brief a period and proof positive of the inherent value of the movement.

It was to be expected that the momentum already attained would make an impression. It has already

done so. No need to point out that lighting equipment used to be conspicuous by its absence in the advertising sections of publications. This condition was well summed up in an article published recently by the statement that "the largest seller advertised the least." But conditions are being changed. Advertisements of lighting equipment are becoming far more numerous and important. Leading publications which had up to now treated the subject with indifference bordering on contempt are opening their pages to authoritative articles on the importance of lighting and the selection of the proper lighting devices, through which alone it becomes available.

IMPORTANCE TO THE INDUSTRY

We believe that all this will mean much for progress. It cannot but help the central stations of the country greatly. The most that manufacturers of lighting devices may expect as the result of this campaign is the increased sale of their products. But the central station will gain continuous revenue from more and more elaborate lighting equipment and a more generous use of light. When we recall the greatly increased volume of electricity which central stations have at their disposal through the recent construction of new generating plants and that the lighting load represents their most profitable business, it is merely stating the obvious when one says that this movement of the lighting-equipment industry is of far greater importance to these central stations than to the manufacturers of lighting devices who originated it.

RENAISSANCE OF LIGHTING

Naturally, it is highly important that electrical men themselves understand the scope and the significance of this campaign. It is not just a matter of a slogan or an advertising campaign to push a certain kind of goods. It is in effect the renaissance of an important branch of the electrical industry—important both in the volume of its sales and the nature of its product. If manufacturers and jobbers and retailers of other kinds of electrical equipment that looks to the American home for its market will see the value of this movement to them, as an influence for selling the electrical idea more fully to the public, they will support it in many ways. And indorsement of this kind will put a mighty impulse behind this work.

Impetus to Electric Cooking and Heating

What the Code Changes Will Mean in the Market—An Acknowledgment of Debt to the N. E. L. A. Wiring Committee

BY RALPH J. PATTERSON
Walker & Pratt Manufacturing Company, Boston

THE report of the N. E. L. A. wiring committee, of which R. S. Hale is chairman, is of more than passing interest in that some very radical changes in the Underwriters' rules governing residence wiring have been allowed, chief among which is the abolition of the 660-watt rule for branch circuits.

The changes noted are in brief as follows:

Solid Neutral Wire.—No fuses required or permitted on middle wire of three-wire circuits.

Fifteen-Ampere Fuses.—These are allowed on branch circuits in place of 10-amp. fuses—no wattage limitation specified.

Three-Wire Branch Circuits.—These are allowed for distribution instead of being limited to two wires as in the past.

Fuses Not Required.—No fuses are required on the grounded size of two-wire branch circuits where the neutral wire is grounded.

It does not require much imagination to see that these changes are more than likely to have a far-reaching effect in increasing the use of portable heating and cooking appliances. For instance, a branch circuit under the old rules, or code, limited the watts on a branch circuit to 660 and the fuse to 10 amp. The new code permits a three-wire branch (No. 14) wire with 15-amp. fuses, allowing the use of 3,000 watts on, let us say, the kitchen circuit. With 3,000 watts available any electric range can be properly demonstrated, and, of course, much larger portable cooking and heating appliances may be used than formerly.

This virtually eliminates all the argument about the cost of wiring, because in most cases the regular wiring, with a three-wire system, is sufficient (say 3,000 watts) for average requirements in the kitchen, especially if care is used in keeping the switches on low or medium points as much as possible.

A hot plate (with oven) or kitchenette range is at once a possibility in every home without the expense of special wiring, because 1,500 watts becomes available under the new rules on every two-wire circuit such as is at present installed in the kitchen of every wired home.

The difference between 660 watts and 1,500 watts in cooking, heating water and for radiators is practically the difference between a plaything and a useful appliance. Many appliances will not be affected by this change. Flatirons, toasters, percolators, etc., are very practical as they are now made, but a wider use of kitchen appliances is sure to be encouraged by the higher wattage permitted on all circuits in residences.

The importance of the new development in electric wiring can hardly be overestimated, and the world owes a debt to the N. E. L. A. and its wiring committee which has brought it about.

Electrical Labor in New York 1919-1923

ACCORDING to the Industrial Commissioner of New York State, the adjustment of labor in the electrical manufacturing plants of that state from 1919 to 1923 to the general business conditions of the country occurred gradually because of the fact that so many different lines are represented. The net decrease in employment during this time was about 50 per cent, but the total decrease for the separate divisions was probably much greater as all of these did not suffer periods of depression together. Even two years after the decline began employment was approximately 30 per cent lower than at the peak.

The commissioner's office further states that the depression of 1920 to 1922 started with overstocking by retailers and the fear of a consumers' reaction against the high prices. The result was that industries producing goods for the retail trade were the first affected by the stoppage of orders and were the first to reduce production. They were usually the first also to show at least a partial recovery. Industries making machinery and other goods for industrial purposes rather than personal use maintained production longer in 1920, but were usually slower in recovering from the depression, as expenditures for new equipment are not ordinarily made until business conditions have improved sufficiently to make a prompt return from the investment appear probable.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

A DEGREE of caution has entered into this week's market, with jobbers and manufacturers in all sections apparently holding back to avoid movements which might destroy in any part the solid buying that has developed only during the last four weeks. Authorities in the trade well realize the dangers that come in pushing a reluctant market too fast and state that there is a slight tendency at the present to avoid campaigns in territories where there is little money to be spent. For this reason the jobbers and manufacturers are doing very little in the rural districts regarding farm-lighting plants, appliances, ranges, etc. They realize that they are to receive many millions of dollars from these now slow markets, and they wish to approach them carefully at the present period so as to secure as many orders as possible after thirty or sixty days' time.

Sales of lamps are increasing by leaps and bounds in all parts of the country, but stocks and production are supplying the demand easily. Orders for miniature lamps are said to be unusually heavy, which is due largely to the fact that most automobile owners are carrying extra kits of lamps for replacements on the roads, and also to the interesting development in Christmas lighting outfits, which are likely to be used in greater numbers during the holiday season to decorate the exterior of houses as well as the trees in the streets.

Wire, poles and cross-arms are moving very rapidly to the central-station companies, which are making many extensions to old lines and repairs to others. Conduit sales are increasing in most sections of the country. Appliances took on another spurt during the week.

Evolution of Lamp Making Machinery and Higher Costs

WITH the many installations of expensive machinery in the lamp works of the General Electric and Westinghouse companies in Ohio and New Jersey during the last year have come higher production costs, which apparently will not allow a lower price to the consumers for at least another two seasons. In the effort to give the people of the United States better illumination by single units of longer life, these companies have decided, so it seems, to give as much quality as possible before considering price decreases.

In the evolution of the lamp industry these new machines are making possible greater output and easier operation, which will result in lower production costs after they have paid for themselves in about three and one-half years' time. These installations are for "tipless" bulbs only, and as the companies have been able to employ many of them in production during the last six months lamps with tips are no longer manufactured.

Officials of these companies are of the opinion that several million lamps with tips are still in the hands of their agents. They point out that as it is necessary to supply the market with approximately 165,000,000 type "B" lamps, 40,000,000 type "C" and 95,000,000 miniature lamps during every twelve months, it is very necessary to hold stocks continually at the sixty-million mark. These authorities believe that it will be 1926 before the lamps with tips will be rarities in the sockets of the consumers.

More Data Needed to Promote Industrial Truck Business

FOLLOWING a decided revival in industrial electric truck sales, there appears to be a temporary condition of quiet, accompanied by more or less so-called "proposition work" on the part of prospective purchasers and manufacturers' agents, at least in Eastern factory areas. This class of equipment is going through a developmental stage as regards the design and production of new units to meet increasingly varied conditions of service, although the well-known flat-platform types of truck and tractor have become standardized sufficiently to be looked upon in many industries at least as a staple tool of mass production.

Available economic data on industrial truck performance are still scarce, and until more complete figures of field service are at the hand of the purchasing engineer the sale of such equipment is bound to proceed along conservative lines as to volume. Industrial-plant engineers and executives are well aware that extraordinary economies in the use of labor and in material handling are being realized in numerous installations, but in too many cases, it is believed, the analysis of local conditions could be speeded up by the presentation of more carefully prepared data based on parallel experience.

Central-station power engineers are still slow to inform themselves as to industrial truck and tractor opportunities, and much of the sales work in this field is still being done by manufacturers' agents, with little real co-operation from utility men, according to well-informed material-handling engineers. There is little that is experimental about the modern industrial truck, and while it is necessarily sold in channels where skilled technical analysis is a feature of distribution, it has become so important a factor in the flexible and intensive handling of materials that its larger recognition by the central station would unquestionably help in the electrification of services at present most inefficiently handled by manual means. A survey of the trend of sales development in this line indicates that the present substantial number of units in service can be greatly increased as the demands of greater production are felt, if the proper amount of technical orders in sight is sufficient to develop the industry.

Used-Machinery Men Seeking New Lines

AN INTERESTING situation has been developing in the used-machinery field. During the war period a tremendous impetus was given to this business. The inability to manufacture and make deliveries and the urgent need for such equipment in all directions placed used machinery at a premium and the dealers reaped a harvest. Moreover, the social standing of used machinery improved, the stigma of the old term "second-hand" was shaken off, and the business was placed on a very substantial basis.

The market for used machinery has been steadily dwindling, however, with the restoration of normal conditions in the manufacturing field, and the dealers have been experiencing a very bad season. The fundamental cause is not just due to the ending of their boom time, but also to the steadily changing conditions in the electrical industry. The small, independent central station and the fair-sized industrial power plant have been the mainstay of the used-machinery market, but the number of small, independent central stations today is rapidly diminishing. More and more of them are being gathered into the larger systems operated by holding companies. The number of industrial power plants also has been rapidly decreasing through the substitution of central stations. There still remain the steel mills, the paper mills and other industrial establishments where because of an inherent need for steam for other purposes the proprietors will continue to operate their own plants, but on the whole the situation has cut deeply into the used-machinery market.

The changing over of many small industrial plants to central-station service has brought a market for rotary converters in many cases, and the used-machinery dealer is selling a good number of them. Gradually, however, his operations are becoming more and more restricted to the sale of motors and to such turbine, generator, boiler and stoker business as he can pick up. This has brought an urgent necessity for the broadening of the line carried by the used-machinery dealer who has heretofore specialized in electrical machinery. A distinct trend has set in, therefore, toward the sale of contractors' equipment. Road machinery,

excavating machinery, concrete mixers and machine tools are being added to electrical apparatus to make a broader line and restore the used-machinery dealer to a better economic position.

General business among the used-machinery dealers has improved materially in the last few weeks after a very quiet summer, and there is a good outlook for a busy season. The necessity for adding new lines, however, is very clear to all dealers, and the movement is definitely under way.

Interesting Details of Electrical Imports Through New York

IMPORTS of electrical machinery, apparatus and supplies through the port of New York during September, 1923, amounted to $47,807. Germany led in the values of most of the commodities that are also sent in by her only important competitors, England and France. The totals for these countries during September are as follows: Germany, $18,732; England, $13,510, and France, $11,653. The highest value in the table of information just issued by the Department of Commerce was for carbons and electrodes imported into this country by France and amounting to $6,400. England sent $3,125 worth of carbons and electrodes, and Germany $5,467. Other countries sent none. Germany is the only country recorded as having sent any flashlamps to this country in September. These amounted to $4,546. Another interesting turn in the foreign field is the great number of advertising machines, $1,881 in value, sent by Germany. No values of these sent from other countries are recorded.

Included under classifications in the import list are many other interesting details: Germany sent $900 worth of hair driers, although there are no records to show that any other country tried to secure any of that business. England sent $6,300 worth of electric piano lamps, while the other countries shipped none. A great number of lighting fixtures were sent into this country during September—France sending a value of $4,603; Germany, $2,634, and Czechoslovakia, $2,945. Only $15 worth of vacuum cleaners, $10 of storage batteries and $97 of electric bells were sent from all the countries of the world during that month.

West Coast Sales More Even; Conduit Reduced

LAMPS along the West Coast are selling briskly in a market which is said by the jobbers to be even and normal throughout the district. The usual sales efforts of the lamp agents are strengthened by excellent publicity programs and other educational work.

The price of conduit has decreased approximately 10 per cent, the carload price for ½-in. black being about $6.50 per 100 ft. from local stocks. Galvanized is quoted at $7.10 in similar lots. The usual autumn business decline in flashlamps has been offset by the introduction of new aluminum styles which are now largely oversold. Standard dry cells also show a large increase in demand, which is partly attributed to the popularity of the new packing in lots of fifty. Great interest is being shown in complete sets of radio.

New York Market Continues Its Steady Increase; Fixtures Active

THE New York market continues its steady increase. Jobbers are buying in conservative amounts and most of them express optimism concerning the coming holiday season. Buying by the central stations shows decided improvement over the corresponding period of last year.

Poles and line hardware are selling very actively as much repair work and extensions are being undertaken by the power companies. Motors in the smaller sizes have a fair market. Radio business is reported even, and a gradual pick-up is expected before the end of the month.

All kinds of fixtures are selling steadily, with firm prices and heavy stocks. A softening in the price of flexible armored conductor is noted. Conduit stocks are somewhat lower than one month ago, owing to the heavy demands of the past two weeks.

Small-Motor Business Active in Boston Section

BUSINESS in the Boston section runs along without much change from week to week. Central-station outputs are gaining steadily, and a good deal of distribution system construction is being pushed this fall. Lamp sales are increasing fast, but enlarged factory facilities are meeting the demand with ease. Sales of small general-purpose motors are active, although not quite up to earlier totals this year. Interest in individual drive is increasing.

Wire, poles and crossarms are moving well, although margins of profit are reported narrow. Wiring contractors are very busy and building operations continue in large totals. Money is easy and electrical apparatus manufacturers are generally hard at work filling back orders and caring for a volume of new business that exceeds that of a year ago in many lines.

Jobbers' stocks are well rounded and deliveries excellent on practically all lines. Building operations reflect marked improvement in volume and prospects are good for next spring. New England department store sales are running about 10 per cent in money above last year, and appliance sales are active among electrical retailers.

St. Louis Business Gained Considerably Last Month

BUSINESS conditions in St. Louis during the past month have shown a considerable gain over the same period last year. New construction and extensions by public utility companies, combined with continued activity in the building industry, are the chief reasons for this increase. Manufacturers and jobbers show a disposition to be cautious and conservative.

Prices generally have been steady, except for a decline in the price of copper wire and wiring devices. Exceptionally cool weather has resulted in unusual demand for electrical heating devices, and the demand for radio sets, ornamental lamps and household appliances is splendid.

Chicago Trade Expecting Much Improvement

JOBBERS and manufacturers in the Chicago district are expecting greatly improved fall business. The trade has resumed its normal trend, with jobbers receiving a growing volume of orders. Pole-line hardware demand has been exceptionally good for the first part of October. Demand for conduit has also increased, with Chicago stocks somewhat depleted and prices firm. One conduit manufacturer states that he booked more tonnage during the first week in October than he did during the entire month of August.

Appliance sales have been good for this week, particularly heaters and appliances used for the chilly mornings. The only price revision reported this week was on flexible armored conductor, which went to $41, Pittsburgh, effective Sept. 28. Wire prices remain the same, although there is gossip of an impending increase in code wire.

Cable Deliveries Improving in Atlanta; Slower Retail Business

THERE have been no particular changes in the jobbing field since last week, with the exception that all jobbers report deliveries on steel wire and cable improving, although the lead variety is still hard to get. One jobber reports a reduction of 1 cent per pound on bare copper wire, effective last week. Apparatus ordinarily handled direct by the manufacturers has slowed up somewhat during the last thirty days, but a sharp pick-up in industrial equipment lines is expected before the first of the year.

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.0337	$0.0337	$0.0292
Cold finished shafting, per lb.	0.0433	0.0433	0.0378
Brass rods, per lb.	0.165	0.17	0.171
Solder (half and half), per lb.	0.262	0.276	0.2283
Cotton waste, per lb.	0.1225	0.1225	0.1458
Washers, cast iron (½-in.), per 100 lb.	4.66	4.66	4.33
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	3.08	3.08	2.96
Machine oil, per gal.	0.349	0.349	0.36
Belting, leather, medium, off list	37%	37%	44½%
Machine bolts, up to 1-in. x 30-in., off list	49½%	49½%	49%

The retail business in Atlanta slowed up noticeably during the past month, particularly in the lighting fixture lines. This is due to the fact that Sept. 1 is "moving day" in this locality and practically all new houses and apartments have to be ready for occupancy on that day. This September lull is usual, and retailers expect the general movement to improve about Nov. 1.

The Metal Market

MOST of the metals have been quiet during the last week, but prices have been well maintained except in the case of copper, which has declined to 13 cents, delivered, as a result of an almost total absence of inquiry. Conditions in the New York lead market are unchanged from last week. A fair volume of business has been done at 6.85 cents for November shipments.

Zinc business has been in fair volume and mostly for October shipment. Prices are substantially the same for November and December, but inquiry for forward delivery has been light. Most of the business has been at 6.30 cents, although a few second-hand lots were disposed of at 6.20 cents. Brass special has sold at 6.40 cents, and high-grade at from 8 cents to 8.50 cents delivered.

NEW YORK METAL MARKET PRICES

	Oct. 3, 1923 Cents per Pound	Oct. 10, 1923 Cents per Pound
Copper, electrolytic	13.37½	13.00
Lead, Am.S.& R.price	6.85	6.85
Antimony	7.75	7.75
Nickel, ingot	27.00 to 32.00	27.00 to 32.00
Zinc, spot	6.40	6.30
Tin, Straits	41.75	41.75
Aluminum, 98 to 99 per cent	25.00 to 27.00	26.00 to 27.00

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

"Delco" Refrigerator Sales Are Double Those for 1922

With the August, 1923, sales of the "Frigidaire" mechanical refrigerators of the Delco-Light Company, Dayton, Ohio, running about double last year's sales, an official of the company expects to make his year's quota of 5,000 shipments before Jan. 1. In August of this year the total was over 3,000, while in August, 1922, only 1,800 had been sold. This, according to Mr. Harlan, is the first year that the mechanical refrigerator has been pushed from a sales standpoint.

The company is now endeavoring to build up a sales organization, and more than two hundred salesmen were added during September. By 1924 more than one thousand salesmen will be employed exclusively in the sale of these mechanical refrigerators. On Oct. 15 all the salesmen will be brought into Dayton for a sales conference on refrigerators and Delco farm lights.

Anaconda Buys National Conduit & Cable Hastings Plant

The American Brass Company, an Anaconda Copper subsidiary, has purchased at receiver's sale the plant of the National Conduit & Cable Company for $3,000,000. Confirmation of this sale was made Oct. 4. The purchase price is the amount of bond issues standing against the property of National Conduit & Cable at Hastings-on-Hudson, N. Y., the bulk of which was bought up some time ago by Anaconda.

The present facilities of this property are operating at fair capacity upon export orders and others for Pacific Coast shipment. The rod and wire mill at Hastings has a capacity of 10,000,000 lb. per month and is in good condition, requiring only minor changes to make it highly efficient.

This new purchase by the Anaconda organization fortifies those wire mills so located as to cater economically not only to domestic but to world demand. One of the largest wire-mill units in the world is owned and operated by the Anaconda Company at Great Falls, Mont. This mill is used to serve the needs of the fast-growing Middle Western and Pacific Coast States. Plants at Ansonia and Waterbury, Conn., under the name of the American Brass Company, provide material for Eastern, Southern and Middle Western States. The Hastings plant is particularly well adapted to the exporting of copper rods and electric wires to continental Europe.

Westinghouse Orders in First Half of Year Gained 28 per Cent

The incoming orders of the Westinghouse Electric & Manufacturing Company for the first half of the fiscal year begun April 1, with September orders partly estimated, were $89,400,000, compared with $69,569,000 in the period for 1922, an improvement of more than 28 per cent. Bookings for the fiscal year ended March 31, 1923, were $152,300,000. September bookings were $10,600,000, against $11,500,000 in August.

Sales billed for the first half were around $74,900,000, with September billings estimated at $13,600,000, topping the previous month by about $600,000. Based on the first half, net earnings for the year are conservatively estimated at well over $8 a share on the $85,776,480 present outstanding common stock, or double dividend requirements. Differently stated, earnings for the present fiscal year will be at least as good as for the year ended March 31, 1923, despite an additional dividend disbursement of $1,197,002 required for the $14,962,500 new common offered in April.

While orders for the second quarter were between $4,000,000 and $5,000,000 under the previous quarter, officials expect an improvement in incoming business this fall, principally in small lines of electrical equipment. Lamp business began to pick up in September and will undoubtedly continue its improvement Orders for central station equipment have slowed up somewhat.

Champion Switch to Use Jeffery-Dewitt Insulators

The Champion Switch Company, incorporated in Ohio, has been formed with the following officers: F. D. Stranahan, president; R. A. Stranahan, vice-president; R. W. Lillie, vice-president and general sales manager; J. F. Sinclair, treasurer and general manager; W. W. Hoffmann, secretary, W. L. Stinson, general superintendent.

The company has taken under lease property owned by the Ferguson Shipbuilding Company, 550 Abbott Road, Buffalo, and will enter into the manufacture of high-tension and low-tension indoor and outdoor switching equipment, bus supports, etc.

The engineers of the company have designed their apparatus to be mounted on and used with Jeffery-Dewitt insulators of the various designs now being produced by that company and additional designs which have been brought out for the particular purpose of use in connection with this class of apparatus. The new designs of insulators will have features not embodied in any other make, being in every sense of the word of unit type in that they can be readily replaced in case of necessity. These designs will offer higher electrical and mechanical values.

It is the belief of the company's engineers that the development of switching gear and apparatus as required by the rapid advancement of the art has heretofore been seriously retarded owing to the inability of switch manufacturers to control the design of porcelains for their particular requirements. The Champion Switch Company fortunately enjoys a relationship with the Jeffery-Dewitt Insulator Company that assures co-operation along these lines.

Irvington Company's Correction

A trade note appearing in the Sept. 15 issue of the ELECTRICAL WORLD to the effect that the Irvington Varnish & Insulator Company had taken over the selling agency of the output of the Harvey Wire Company of Newark, N. J., manufacturer of enameled wire, silk and cotton covered wire, etc., was in error as regards its headquarters, which are in Irvington, N. J., not in San Francisco.

Electric Truck Firms' Exhibit at New York Electrical Show

A feature of the Electrical and Industrial Exposition which will be held in the Grand Central Palace from Oct. 17 to 27 will be an exhibition of electric trucks on the north side of the second floor. Among the truck and accessory exhibitors will be Autocar, Commercial, O. B. Electric, Steinmetz, Walker, Walter, Baker, Edison Storage Battery, Electric Storage Battery, Philadelphia Storage Battery, Otto Sarvas, General Electric and Westinghouse.

Thursday, Oct. 18, has been designated as "Electric Truck Day." There will also be an electric truck luncheon during the show and a meeting of the Electric Truck Manufacturers' Association.

Habirshaw Case Postponed

The hearing in the case of the Habirshaw Electric Cable Company was postponed by Federal Judge Knox of the New York federal court last week to Oct. 20, at the request of both the creditors' reorganization committee and the stockholders' committee. The former committee asked for a week's postponement in which to prepare its papers, and the stockholders' committee moved that the hearing go over for two weeks to allow the attendance of counsel.

Since Malcolm D. Whitman, chairman of the reorganization committee, notified the creditors of the Habirshaw and subsidiary companies, the Electric Cable Company and the Bare Wire Company, Inc., that the reorganization plan had been declared operative, the committee of stockholders has renewed its efforts to have the case aired in court. The stockholders charge that certain interests among the large creditors of the failed concern would wipe out the stockholders if by so doing they could get control of the company for themselves.

Western Electric Acquires More Property for Hawthorne Works

For the third time within six months the management of the Hawthorne Works, Western Electric Company, in Chicago has been forced to go outside its own 216-acre area for more space to provide for continually growing manufacturing requirements. The latest expansion of the works has just been accomplished by the acquisition of a one-story building in the new Ashland industrial center at Seventy-fourth Street and Ashland Avenue. The lease for the new building, which will give the Western Electric 160,000 additional feet of space in Chicago, was closed Sept. 25.

The acquisition of new quarters at the southwest border of the city will enable the Hawthorne organization to draw new employees from an area it has never looked to for man power. Executives of the company estimate that by the time the new plant is in full running condition it will have been the means of adding at least one thousand men and two hundred and fifty women employees to the Western Electric forces. One hundred thousand square feet in the building will be used for manufacturing purposes and the other sixty thousand feet will be assigned to the merchandise department.

Benjamin Starts Jobber Window Display Campaign

In order to assist jobbers and dealers in the sale of the Benjamin two-way plug, the Benjamin Electric Manufacturing Company, 847 West Jackson Boulevard, Chicago, has announced a Hallowe'en window display contest starting the week of Oct. 24.

For the best window decorated with material obtained from the Benjamin Electric Company a first prize of $100 will be given. Other prizes range down from $75 to $10. The windows will be judged on the basis of the most attractive appearance from the outside view and for the best original use in creating sales value.

Wesco Supply Receives Large Stock of Electric Ranges

The Wesco Supply Company of St. Louis has recently authorized the concentration of a large supply of electric ranges in St. Louis. The Wesco Supply Company believes that the design it sells has become reasonably standard, and this large stock is to be kept in order that the company may be able to give a more dependable service for popular types of electric ranges. Initial shipments of this newly authorized stock have already been received.

The B. F. Sturtevant Company, Hyde Park, Boston, is buying considerable new machinery for installation in its plant in Racine County, Wis. The company is now employing one hundred operatives and expects to increase the number to three hundred by Jan. 1. The Sturtevant works have orders amounting to more than $500,000.

The H. T. Electric Company, 612 North Capital Avenue, Indianapolis, manufacturer of electrical equipment and supplies, is taking bids for a one-story-and-basement addition, estimated to cost $30,000.

The Pelton Water Wheel Company, Nineteenth and Florida Streets, San Francisco, will soon commence the erection of a two-story addition, estimated to cost $100,000, including machinery.

The Electric Furnace Construction Company is now in its new offices in the Jefferson Building, 1015 Chestnut Street, Philadelphia.

The Electric Heating Apparatus Company, Newark, N. J., manufacturer of heavy-duty furnaces, has opened a Chicago office at 140 South Dearborn Street, with F. A. Hansen as district manager. Mr. Hansen was formerly connected with the Westinghouse Electric & Manufacturing Company.

The Dayton Fan & Motor Company, Dayton, Ohio, has leased two buildings adjoining its plant, giving it an additional 20,000 sq.ft. of floor space.

The Union Electrical Company, Baltimore, has leased a three-story building at Charles Street and Lafayette Avenue for new local works. Immediate occupancy is being arranged.

The Standard Electric Stove Company, Toledo, Ohio, has leased a portion of the large plant of the Engman-Matthews Range Company, Goshen, Ind., and plans for the early establishment of a new plant at this location. It is purposed to remove the present Toledo works to the Goshen factory, with the installation of additional equipment.

The Mathews Brothers Company, 1661 West Washington Street, Los Angeles, manufacturer of batteries and other electric products, has acquired property at 1729 Santee Street and contemplates the erection of a new plant, for which plans will be drawn in the near future.

The Northeast Electric Company, Rochester, N. Y., is developing maximum capacity at its plant and has recently inaugurated an overtime schedule, giving employment to additional workers. It is expected to maintain the present basis of production for at least six months to come.

George Bender, 128 Center Street, New York City, agent for electrical machinery, has taken up the sale of the "Townsend" combination armature coil winder and puller. This is an adjustable-slot machine similar to other winding machines, but has attachments so that the operator after winding the coil pulls it into shape on the same machine. It is adjustable for any size from 1 hp. to 200 hp.

The Reinforced Switch & Manufacturing Company, Inc., 400 East North Avenue, Pittsburgh, announces that it has concluded arrangements whereby the W. O. Conley Electric Company of Philadelphia will sell its products in southern New Jersey and eastern Pennsylvania.

The B. B. T. Corporation of America, 810 Atlantic Building, Philadelphia, recently incorporated, will act as the American distributor for the products of Barbier, Benard & Turenne of Paris, France, manufacturers of electric lighting equipment. Material is at present being imported from the main factory in France, but plans are under way for manufacturing certain parts in this country. W. W. Kellett is secretary and treasurer.

Henry Newgard & Company, electrical contractors, 947 West Washington Boulevard, Chicago, are taking bids on a three-story factory, 75 ft. by 118 ft., at 125 South Morgan Street, Chicago, to cost $90,000.

The Reliance Electric Company, 1313 Moorman Street, Chicago, manufacturer of electrical equipment, has awarded a contract for a two-story-and-basement addition estimated to cost $55,000.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Vienna, Austria (No. 7,931), for air compressors with electric motors.

An agency is desired in Auckland, New Zealand (No. 7,936), for electric trucks; also for builders' cranes or hoists.

Purchase is desired in Marseilles, France (No. 7,898), for electric trucks.

Purchase and agency is desired in Christiania, Norway (No. 7,910), for electrolytic copper, cables, rods, etc.

An agency is desired in Johannesburg, South Africa (No. 7,916), for electrical household appliances.

Purchase is desired in Ahmedabad, India (No. 7,906), for electrical novelties, such as pocket torches, handlamps, refills, bulbs, bells, wires and accumulators.

Purchase is desired in Basse-Terre, Guadeloupe (No. 7,915), for radio receiving sets; also for turbine (110 volts) complete with switchboard and also for rheostat (No. 7,917).

FEEDER AND PILOT CABLES FOR SYDNEY, AUSTRALIA.—Tenders will be received by the City Council, Sydney, Australia, until Dec. 3 for high-tension feeder and pilot cables.

PROPOSED TELEPHONE LINES IN FRENCH INDO-CHINA.—Following an intensive campaign on the part of the Saigon Chamber of Commerce, according to *Commerce Reports*, the government has announced that the following telephone lines will be erected by the end of 1924: Mytho-Vinlong-Cantho; Cantho-Sectrang-Baclieu; Saigon-Ca St. Jacques, and two new Saigon-Pnompenh lines. The proposed new lines will cover a distance of more than 1,000 km.

PROPOSED HYDRO-ELECTRIC DEVELOPMENT ON CARUAO RIVER, VENEZUELA.—The construction of a hydro-electric plant on the Caruao River is contemplated by a Caracas syndicate, *Commerce Reports* states, to supply additional power to the city of Caracas. It is estimated that 3,000 hp. can be developed, which would be transmitted about 37 miles. It was originally intended to finance this project locally, but owing to the recent death of one of the proposed subscribers it is now hoped to obtain at least part of the funds abroad. American firms interested in this project can obtain names of the members of the above syndicate from the Electrical Equipment Division, Department of Commerce, Washington, D. C., or through any of the district offices of the bureau, by referring to file No. 105,419.

New Apparatus and Publications

ELECTRIC SOLDER POT.—A new electric solder pot with automatic heat control has been placed on the market by J. D. Wallace & Company, 1401 West Jackson Boulevard, Chicago.

MOTOR-DRIVEN CHAIN BLOCK.—The Motorbloc Corporation, Philadelphia, has issued bulletin No. S-801, describing and illustrating the application of the "Motorbloc" in several capacities.

PULVERIZED-FUEL EQUIPMENT.—The Combustion Engineering Corporation, New York City, has issued a catalog relative to its "Lopulco" fuel systems.

CARBON BRUSHES.—The Pure Carbon Company, Wellsville, N. Y., has issued catalog No. 4, covering proper recommendation of brush grades for various classes of service and the basis upon which recommendations are made. The catalog also illustrates and describes the various styles and designs of shunt connections.

OIL CIRCUIT BREAKERS.—The Metropolitan-Vickers Electrical Company, Ltd., Manchester, England, has issued leaflet 255 1-1, describing its type "K" oil circuit breaker.

SWITCHING EQUIPMENT.—"Automatic Switching Equipment for Waterwheel-Driven Alternators" is the title of instruction book 87,714A issued by the General Electric Company, Schenectady, N. Y. The company is also distributing a booklet covering its automatic station-control equipment.

FLUE-GAS FILTER.—The Uehling Instrument Company, Paterson, N. J., has brought out bulletin No. 116A, illustrating devices which it is said prevent fouling and corrosion of CO_2 equipment and the tubing which conveys the gas sample to the instrument continuously.

MOTORS.—The Hertner Electric Company, Cleveland, is issuing bulletin No. 10A, which describes its 40-deg. polyphase induction motors in sizes from ½ hp. to 50 hp.

MOTORS.—The Reliance Electric & Engineering Company, Cleveland, is issuing bulletin No. 2014, describing its type "Treliance" motors for direct-current circuits.

MOTORS.—The Burke Electric Company, Erie, Pa., is issuing bulletin No. 128, describing polyphase induction motors.

CIRCUIT BREAKERS.—The Roller-Smith Company, New York City, is issuing bulletin No. 560, describing its inclosed circuit breakers, types "P" and "E."

SWITCHBOARD INSTRUMENT.—The Roller-Smith Company, New York City, is issuing bulletin No. 450, describing its new switchboard instrument, type "Lida," for use in educational institutions or elsewhere, where a very large instrument whose indications are visible from a considerable distance is wanted.

SLUICEGATES.—Philips & Davies, Kenton, Ohio, are issuing leaflets which describe the caterpillar type sluicegates as manufactured by them under the Broome patents.

INSULATING MATERIALS.—The Mitchell-Rand Manufacturing Company, 18 Vesey Street, New York City, is issuing a handbook, "Everything in Insulation."

TRANSFORMERS.—The Pittsburgh Transformer Company, Pittsburgh, has issued bulletins Nos. 2023 and 2024, the first descriptive of its distributing transformer and the second showing various phases of the manufacture of its power transformers.

INDUSTRIAL ELECTRIC TRACTOR.—The Mercury Manufacturing Company, Chicago, has brought out the "Mercury" type H internal-gear electrically driven tractor for industrial use.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

CARIBOU, ME.—The board of directors of Cary Hospital will build a power house at its proposed hospital. H. W. Rhodes, 574-A Congress Street, Portland, is architect.

WOODLAND, ME.—The St. Croix Paper Company plans to enlarge its power plant, including the installation of additional equipment. Contract has been let for a 4,550-hp. turbine unit. Orders will be placed for other equipment at an early date.

PORTSMOUTH, N. H.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Oct. 23, for nine motors, spare parts and control appliances for the local navy yard. (Schedule 1397.)

BOSTON, MASS.—The Edison Electric Illuminating Company plans to issue $9,083,340 in capital stock, part of the proceeds to be used for extensions and improvements.

BOSTON, MASS.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Oct. 23, for armature machines for the Boston and Philadelphia Navy Yards. (Schedule 1401.)

MERIDEN, CONN.—The Connecticut Light & Power Company is preparing plans for the construction of a substation on Hanover Street.

Middle Atlantic States

AMSTERDAM, N. Y.—The Adirondack Power & Light Company contemplates increasing the output of its steam-driven electric plant on the Mohawk River to 80,000 hp. Contract for a turbo-generator has been awarded and orders for other equipment will soon be placed. Additional transmission lines will be built. The cost is estimated at $3,000,000.

BROOKLYN, N. Y.—Electric power equipment will be installed in the proposed ice-manufacturing plant to be erected on Lorimer Street by the Rubel Coal & Ice Corporation, 197 Glenmore Avenue, to cost about $500,000. E. M. Adelsohn, 1770 Pitkin Avenue, is architect.

BUFFALO, N. Y.—Plans have been approved for the installation of a street-lighting system on Richmond Avenue, from Colonial Circle to Forest Avenue, and on Peckham Street, from Jefferson Avenue to Sears Street.

FAR ROCKAWAY, N. Y.——The Queensborough Gas & Electric Company has issued $2,000,000 in bonds, part of the proceeds to be used for extensions and improvements.

GENESEE, N. Y.—The Genesee Light & Power Company plans to erect a transmission line on Crittenden and Bloomingdale Roads. Lighting systems will be installed on both highways.

HUDSON, N. Y.—Electric power equipment will be installed by the Hoboken Paper Mill, Inc., 151 Fifth Avenue, New York, in connection with the rebuilding of its plant at Gould Station, recently destroyed by fire. The cost is estimated at about $200,000.

JEWETTSVILLE, N. Y.—Electric Power equipment will be installed by the Clay Products Company in connection with the rebuilding of its local plant, recently destroyed by fire. The cost is estimated at $100,000.

PERRY, N. Y.—The Perry Knitting Company plans to build a power plant at its mill.

PERRY, N. Y.—The Perry Electric Light Company plans to build an addition to its power plant. Work has started on a transmission line to Retsof, where connection will be made with the system of the Niagara Falls Power Company.

POTSDAM, N. Y.——The St. Lawrence County Utilities, Inc., recently organized, will take over the Potsdam Electric Light & Power Company, Massena Electric Light & Power Company, Ogdensburg Gas Company and the Ogdensburg Power & Light Company. Extensions and improvements are contemplated to the systems.

NEWARK, N. J.—The Public Service Electric Company will build a substation at its Point-No-Point power plant, to cost about $30,000.

SOUTH ORANGE, N. J.—Bids will be received by the Water Committee, Board of Trustees, until Oct. 19, for one motor-driven triplex pump of 225 gals. capacity per minute, with control equipment and auxiliary apparatus, for the local waterworks. Nicholas S. Hill, Jr., 112 East Nineteenth Street, New York, is consulting engineer.

BAIRD, PA.—The West Penn Power Company has applied for permission to erect a transmission line on steel towers across the Monongahela River, comprising six 132,000-volt lines, two 22,000-volt lines, two telephone lines and two ground wires.

CATASAQUA, PA.—The Bryden Horseshoe Company plans for the complete electrification of its works, replacing present steam-power equipment, in connection with extensions and improvements to cost more than $150,000.

ENOLA, PA.—The Pennsylvania Railroad Company is reported to be planning to equip its local yard for electrical operation.

EPHRATA, PA.—Plans are under consideration for improvements to the municipal electric plant, to cost about $50,000, for which bonds will be voted.

HARRISBURG, PA.—The Manada Electric Company, recently organized, represented by John E. Snyder, local attorney, plans to erect a transmission line in South Hanover Township.

HARTLETON, PA.—Leroy E. Yagel has applied to the Public Service Commission for permission to organize a company to install and operate an electric plant for commercial service in Hartleton and Hartley townships.

HARVEYS LAKE, PA.—The Harveys Lake Lighting Company has acquired the Noxen Electric Company, Kunkle's Electric Company and the Lehman Center Light Company, operating in adjoining districts. The properties will be consolidated and extensions made in transmission system.

JOHNSTOWN, PA.—Penn Public Service Company plans for a stock issue of $100,000, the proceeds to be used for extensions and improvements.

JOHNSTOWN, PA.—G. C. Savering, Johnstown, and associates have organized

the Kingsley, Hickory, Howe and Green Township Public Service Companies and the Forest Public Service Company, to install and operate transmission lines in the respective districts named.

OIL CITY, PA. — The Penn-American Refining Company plans to build an electric generating plant at its local refinery.

PARRYVILLE, PA. — The Lehighton Electric Light Company will install a local commercial system. Lines will also be extended to Weissport and in Mahoning Township for similar service.

PHILADELPHIA, PA.—The Philadelphia Electric Company has acquired a site on the Delaware River at the foot of Erie Avenue, for a new generating plant, on which work will be started early in 1924. The initial unit will have a capacity of about 40,000 kw. The cost is estimated at $5,000,000. Plans are also being prepared for a large distributing plant in this section.

PITTSBURGH, PA.——The Duquesne Light Company has awarded a contract for prime movers and other electrical machinery for its Colfax power plant. Orders for additional equipment will be placed at an early date. The cost of the work is estimated at $1,000,000.

BALTIMORE, MD.—Arrangements are being made for the construction of a 3,000-hp. power plant at the Johns Hopkins Hospital. Joseph E. Sperry, Calvert Building, is architect.

FAIRMONT, W. VA.—The Continental Coal Company, recently organized, contemplates the installation of electric power equipment and mining machinery at its property in Monongalia County.

FAIRMONT, W. VA.—Robert Talbott & Company plan for the installation of electric power equipment and mining machinery at their properties in Monongalia County.

KEYSER, W. VA.—The installation of electrically operated pumping machinery at the municipal waterworks is under consideration. J. N. Chester, Union Building, Pittsburgh, is engineer.

KILLARNEY, W. VA. — The Killarney Smokeless Coal Company, Lynchburg, Va., recently organized with a capital of $1,000,000, contemplates the installation of electric power and mining equipment at its local properties. James Gorman is president.

MORGANTOWN, W. VA.—The Monongahela West Penn Public Service Company has issued $1,500,000 in bonds, part of the proceeds to be used for extensions and improvements.

NEWPORT NEWS, VA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Oct. 23, for seventy-six radiant electric heaters. (Schedule 1395.)

WASHINGTON, D. C.—The Washington Railway & Electric Company is considering an issue of $2,496,500 in bonds, part of the proceeds to be used for extensions.

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, until Oct. 27, for high-tension insulators and fittings, electric wire and cable, electric bells and fixtures, etc. (Circular 1564.)

North Central States

BATTLE CREEK, MICH.—Plans are being considered for the installation of a fire-alarm system, to cost about $10,000. E. U. Hunt, City Hall, is engineer.

DETROIT, MICH.—The Board of Education will build a power house, to cost about $30,000, in connection with a new school on Cameron Street. Malcomson, Higginbotham & Palmer, Industrial Building, are architects.

DETROIT, MICH.—The Ford Motor Company, Highland Park, has taken an option on a site on the Rifle River, near Omer, for a proposed hydro-electric plant. It will be the first of six plants to be built by the company in this section.

GRAND HAVEN, MICH.—Plans are being completed for the construction of a municipal electric plant on Water Street, to cost about $75,000. A. C. Clark, 1151 Columbus Avenue, is architect.

GRAND RAPIDS, MICH.—Electric power equipment will be installed in the new local cement-plaster manufacturing plant of the Certain-Teed Products Corporation, 100 East Forty-second Street, New York, on which work has been commenced. It will cost about $200,000.

JACKSON, MICH.— Preliminary plans are being prepared by the Consumers' Power Company for a hydro-electric power plant on the Manistee River, with initial output of 25,000 kw., to cost about $400,000. The Fargo Engineering Company, Citizen-Patriot Building, is engineer.

KALAMAZOO, MICH.—The Valley Paper Company, recently organized, will build a power plant at its proposed local mill, to cost $900,000. Billingham & Cobb, Press Building, are engineers.

PEWAMO, MICH. — The Community Power Company has acquired the local municipal electric system and will furnish service from its plant at Hubbardstown. It is planned to install systems at Fowler and Westphalia.

BARBERTON, OHIO—Tentative plans are under consideration for the installation of electrically operated pumping machinery in connection with extensions to the waterworks.

LIMA, OHIO—The Ohio Power Company is planning to build a transmission line from Fostoria, to cost about $550,000. A local substation will be built at a cost of about $215,000. A new switching station will be erected at Fostoria, to cost $115,000. Plans are also under way for the erection of a transmission line from the power plant at Philo to Canton, to cost about $1,000,000.

LORAIN, OHIO — Arrangements have been made by the Ohio Public Service Company for the erection of a transmission line along the right-of-way of the Baltimore & Ohio Railroad in this section.

ROCKY RIVER, OHIO—Plans are being arranged for the installation of electrically operated pumping machinery in connection with a new waterworks plant to be used jointly by the towns of Rocky River, Bay and Dover, to cost about $300,000. E. A. Arnold is engineer.

TOLEDO, OHIO.—The Toledo Edison Company is disposing of a bond issue of $900,000, part of the proceeds to be used for extensions.

YOUNGSTOWN, OHIO.—The Ohio River Edison Company, recently organized to construct a local generating plant, has arranged for an increase in capital stock of $9,000,000, part of the proceeds to be used for plant and transmission-line construction.

ASHLAND, KY.—The Kentucky Face Brick Corporation, recently organized, plans to build an electric plant at its proposed local works, to cost about $150,000.

WINAMAC, IND.—The Interstate Public Service Company will build a 13,200-volt transmission line from a point near Francisville, about 15 miles, for local service. The municipal power station will be closed.

ANNA, ILL.—A power plant will be installed at the proposed local cement plant to be built by A. A. Fasig, Anna, and associates, to cost about $750,000.

MASON, ILL.—The Illinois Coal Corporation, Old Colony Building, Chicago, contemplates the construction of a power plant at its local properties.

LAKEVILLE, MINN.—Plans are under consideration for the installation of electric pumping machinery in connection with a new waterworks system. Druer & Milinowski, Globe Building, St. Paul, are engineers.

ARMSTRONG, IOWA.—The Iowa Falls (Iowa) Electric Company has acquired the property of the Emmet County Light & Power Company. Extensions and improvements are contemplated to the system.

MOUNT VERNON, IOWA.—The Iowa Railway & Light Company, Cedar Rapids, has purchased the property of the Wapsie Power Company and will make improvements, including extensions in transmission lines.

LEXINGTON, MO. — The McGrew Coal Company contemplates rebuilding its power plant and machine shops, recently destroyed by fire. The loss is estimated at $90,000.

LINCOLN, NEB.—The Continental Gas & Electric Corporation has issued $1,000,000 in bonds, part of the proceeds to be used for extensions.

KANSAS CITY, KAN.——The Kaw Valley Drainage District, 719 Osage Street, plans to install twenty electrically operated pumping units, to cost about $185,000.

TECUMSEH, KAN.—Preliminary plans are being prepared by the Illinois Power & Light Corporation, Peoria, Ill., for a new 15,000-kw. steam-driven electric plant in this vicinity, to cost about $2,000,000, with transmission system.

Southern States

ANDREWS, N. C.—Bids will be received by the Board of Aldermen until Oct. 24 for the construction of a 1,250-kw. hydro-electric plant on the Hiawassee River, including hydraulic and electrical machinery and auxiliary equipment, power station, 11-mile transmission line and power dam 390 ft. long and 40 ft. high. The Ludlow Engineers, Inc., Winston-Salem, N. C., are engineers.

AHOSKIE, N. C.—The Wall Street Tobacco Company, 79 Wall Street, New York, will build a power house at its proposed local plant, to cost about $375,000.

BURLINGTON, N. C.—The Queen Anne Textile Company plans to build a power house at its proposed local cotton mill, to cost about $1,000,000.

CENTRAL FALLS, N. C.—The Central Falls Manufacturing Company plans to construct a hydro-electric plant for local service.

COLUMBIA, S. C.—The Columbia Railway & Navigation Company is planning to build a 40,000-hp. hydro-electric plant on the Cooper River. A transmission line will be erected to Georgetown, Orangeburg and vicinity. The project will cost about $1,000,000.

WESTMINSTER, S. C.—Plans are under consideration for the installation of electrically operated pumping machinery at the proposed municipal waterworks, to cost about $150,000.

DALTON, GA.—The American Thread Company, 260 West Broadway, New York City, plans to construct a 1,500-hp. power plant at its proposed local mill, to cost about $1,000,000. Lockwood, Greene & Company, Atlanta, are engineers.

CRESCENT CITY, FLA.—Bonds for $39,500 have been sold, part of the proceeds to be used for extensions to the municipal electric system.

TALLAHASSEE, FLA.—The West Florida Power Company has acquired the local municipal electric plant under lease for a period of years and will make extensions and improvements for increased service.

MEMPHIS, TENN.—The Southern Hotel Company will install an electric plant at its proposed Hotel Peabody on Union Avenue, to cost about $2,000,000, for which bids will be called early in November. The equipment will include three 200-kw. generators and auxiliary apparatus. W. W. Ahlschlaeger, Inc., 65 East Huron Street, Chicago, is architect.

GADSDEN, ALA.—The Alabama Power Company has applied for permissioin to build a hydro-electric plant on the Coosa River. The plans call for an ultimate capacity of 100,000 hp., to cost about $3,000,000.

GREENVILLE, ALA. — The Alabama Power Company, Birmingham, has acquired the property of the Electric & Manufacturing Corporation. Local service will be furnished from the proposed transmission line of the Alabama company from Montgomery.

TUSCALOOSA, ALA. — The Alabama Power Company is arranging for a bond issue of $4,000,000, the proceeds to be used in connection with the purchase of the property of the Tuscaloosa Railway & Utilities Company and proposed extensions.

JONESBORO, ARK.—The Jonesboro Cotton Mills, Inc., recently organized, plans to construct a power house at its proposed local textile mill, to cost about $400,000.

GIBSLAND, LA.—Plans are being prepared for extensions and improvements in the municipal electric system. E. T. Archer & Company, New England Building, Kansas City, Mo., are engineers.

LEESVILLE, LA.—Plans are under consideration for the installation of electrically operated pumping machinery at the proposed new waterworks plant, to cost about $150,000. E. T. Archer & Company, New England Building, Kansas City, Mo., are engineers.

ENID, OKLA.—The Oklahoma Gas & Electric Company has commenced the erection of a transmission line to Drumright via Covington. Substations and distributing systems will be installed at both places.

KIEFER, OKLA.—The Oklahoma Union Railway Company plans to construct a number of substations in connection with a new traction line to Okmulgee via Nuyaka, about 32 miles.

OKMULGEE, OKLA.—Electrically operated pumping machinery will be installed at the municipal waterworks in connection with extensions to cost about $1,000,000. Burns & McDonnell, Interstate Building, Kansas City, Mo., are engineers.

CALVERT, TEX.—The Madison Oil & Coal Company, Westheimer Building, Houston, plans to construct a power plant in connection with a new coal tipple at its local properties.

KENEDY, TEX.—Plans are under consideration for the installation of electrically

operated pumping machinery at the municipal waterworks.

SAN ANTONIO, TEX.—The installation of an ornamental lighting system on Broadway, between Tenth and Houston Streets, is under consideration.

Pacific and Mountain States

BELLINGHAM, WASH. — The Utah-Idaho Sugar Company, Salt Lake City, Utah, plans to construct a power plant at its proposed local sugar mill, to cost about $1,000,000.

TONO, WASH.—The North Coast Power Company has applied for a franchise in Thurston County to erect a transmission line from Bucoda to Tono to furnish electricity here.

WALLA WALLA, WASH.—Plans are being considered for the construction of a 4,000-hp. hydro-electric plant in connection with an irrigation project in this district, to cost about $1,500,000. Ernest B. Hussey, Alaska Building, Seattle, is engineer.

WINLOCK, WASH. — Electric power equipment will be installed in the proposed local ice-manufacturing plant to be erected by the City Transfer Company, Centralia.

HILLSBORO, ORE.—William Briot is considering plans for the construction of a power plant on Panther Creek, where a water right has been secured.

KLAMATH FALLS, ORE.—The California-Oregon Power Company is completing arrangements for the purchase of the Douglas County Light & Water Company, Roseburg, and will make extensions and improvements in plant and system. Bonds for $1,000,000 have been issued, a portion of the fund to be used for the expansion.

COLUSA, CAL.—Arrangements are being consummated for the purchase of the local power plant and distributing system of the Pacific Gas & Electric Company, to be operated in the future as municipal property. Extensions and improvements are planned.

CROCKETT, CAL.—The Great Western Power Company contemplates the rebuilding of the portion of its local power plant, destroyed by fire Sept. 21, with loss approximating $100,000, including equipment.

CUDAHY, CAL. — The National Paper Products Company, a subsidiary of the Zellerbach Paper Company, 534 Battery Street, San Francisco, plans to build a power plant at its proposed local paper mill, to cost about $2,000,000.

FRESNO, CAL.—The San Joaquin Light & Power Company has secured permission from the State Water Department to construct a hydro-electric plant on the San Joaquin River, Fresno County, to develop 6,700 hp.

FRESNO, CAL.—Arrangements are being made for the installation of ornamental lamps on portions of Broadway, North Broadway, Wishon, Olive and Forthcamp Avenues. The plans provide for 350 standards with underground conduit system. William Stranahan is city engineer.

LOS ANGELES, CAL.—The Department of Public Service, Bureau of Light, plans to build a substation at 3514 South Normandy Avenue.

LOS ANGELES, CAL.—The San Pedro Lumber Company, Wilmington district, will build a substation at its plant at Wilmington and San Pedro Roads.

LOS ANGELES, CAL.—Electric power equipment will be installed at the proposed plant of the Los Angeles Cotton Mills, Inc., 628 Metropolitan Building, on site near the city limits, estimated to cost about $150,000. M. H. Merrill & Company, 50 State Street, Boston, Mass., are engineers.

NEWPORT BEACH, CAL.—The installation of an ornamental lighting system in the Peninsula section, near Balboa, is under consideration. Paul E. Kressly, 732 H. W. Hellman Building, Los Angeles, is city engineer.

SACRAMENTO, CAL.—Ray L. Allin, Sacramento, and associates have applied to the State Water Department for permission to construct a series of hydro-electric plants on Clear Lake, Cache Creek, Tiegler Creek and Putah Creek, in Yolo, Lake and Napa Counties, with total output of 215,000 hp.

SAN FRANCISCO, CAL. — The Pacific Gas & Electric Company has secured permission from the State Reclamation Board to construct a substation on the Wadsworth Canal.

TWIN FALLS, IDA.—The board of directors of the Milner Canal System plans to construct a power plant to cost about $125,000 in connection with the canal project.

TUCSON, ARIZ.—The Tucson Gas, Electric Light & Power Company plans to erect a transmission line in the Sawtelle and Metz districts.

WILLIAMS, ARIZ. — Plans are under consideration for the installation of electric pumping machinery in connection with extensions and improvements in the municipal waterworks. The Burns & McDonnell Engineering Company, Marsh-Strong Building, Los Angeles, is engineer.

BUTTE, MONT.——Plans are being arranged for the installation of an ornamental lighting system in streets adjoining the business section, to cost about $24,000. The installation of ornamental lamps on Argyle and Phillips Streets is also under consideration.

Miscellaneous

PETERSBURG, ALASKA.—Plans are being arranged for a hydro-electric plant in Petersburg, for which bids will be received until about Nov. 1 by Hubbell & Walker, Alaska Building, Seattle, engineers. The equipment will include two water turbines of 500 hp. each, two generators of 500 hp. each, and auxiliary apparatus; also apparatus for a 15-mile transmission line. The project will cost about $100,000.

ANCHORAGE, ALASKA.—Bids will soon be called by the Constructing Quartermaster, United States Army, Fort Mason, Cal., for the construction of a power house in connection with a number of new buildings here for an army post, to cost about $700,000. An electric lighting system will also be installed.

Electrical Patents

Announced by U. S. Patent Office

(Issued Sept. 18, 1923)

1,468,593. AIR-HEATING UNIT; E. M. Erb, Jersey City, N. J. App. filed Aug. 26, 1922. Designed to heat air or gases passing through apparatus.

1,468,610. WRAPPING MACHINE; J. Scherner, Milwaukee, Wis. App. filed Aug. 4, 1922. Electrically driven tire-wrapping machine.

(Issued Sept. 25, 1923)

15,689 (reissue). CONDENSER; C. D. Tuska, Hartford, Conn. App. filed March 29, 1919. Adjustable condenser made of paper and metal foil.

1,468,649. PROCESS FOR ELECTRICALLY TREATING LIQUIDS; H. B. Rudd, Mansfield, Ohio. App. filed March 3, 1920. To destroy any bacteria therein.

1,468,653. CONDENSER; C. D. Tuska, Hartford, Conn. App. filed July 30, 1923. Made of tinfoil and paper.

1,468,660. SIGNALING SYSTEM; A. P. Davis, Brooklyn, N. Y. App. filed Dec. 30, 1919. Applied to fortifications and warships.

1,468,680. WHEEL MOUNT; E. Telleson, Binghamton, N. Y. App. filed April 26, 1919. For trolley poles.

1,468,687. TRANSMISSION REGULATION; H. A. Affel, Brooklyn, N. Y. App. filed May 4, 1922. For carrier current or radio telephone system.

1,468,701. SWITCH MECHANISM; V. R. Despard, Hinsdale, Ill. App. filed March 6, 1917. Chain switch for lamp sockets.

1,468,704. APPARATUS AND METHOD FOR MEASURING TRANSMISSION; H. S. Hamilton, New York, N. Y. App. filed Dec. 5, 1921. Of radio signals.

1,468,721. GARMENT IRONER; B. W. Macy, Jacksonville, Fla. App. filed Jan. 21, 1922. Heat generated is communicated to ironing surface by insulating liquid.

1,468,722. ELECTRICAL HEATING DEVICE; B. W. Macy, Jacksonville, Fla. App. filed May 6, 1922. Water heater.

1,468,723. ELECTRICALLY HEATED IRONING DEVICE; B. W. Macy, Jacksonville, Fla. App. filed May 6, 1922. Heating element immersed in liquid.

1,468,729. AUTOMATIC REGULATOR; J. S. O'Hara, Romney, W. Va. App. filed Sept. 3, 1920. To maintain constant temperature, speed, pressure, frequency, quantity or vacuum

1,468,756. DIMMER ATTACHMENT FOR VEHICLE SYSTEMS; G. J. Smith, Peoria, Ill. App. filed Feb. 20, 1922. Dimmer control button on steering wheel.

1,468,764. ELECTROPLATING APPARATUS; Van Winkle Todd, Millburn, N. J. App. filed Dec. 27, 1922. Continuous process.

1,468,789. ELECTRIC CONTACT OPERATING DEVICE; O. M. Leich, Genoa, Ill. App. filed April 24, 1918. For alternating-current rectifiers.

1,468,793. SWITCH FOR CONTROLLING IGNITION CIRCUITS; J. A. Bessey, Jr., Marcellus, N. Y. App. filed May 10, 1922. For preventing theft of vehicle.

1,468,830. SIGNAL FOR AUTOMOTIVE VEHICLES; A. S. Ouzoonian, New York, N. Y. App. filed May 17, 1922. Combined taillight, direction indicator and device for holding and illuminating license plate.

1,468,838. CATHODE FOR THE ELECTROLYTIC REFINING OF METALS; C. H. Schuh, Brooklyn, N. Y. App. filed Sept. 22, 1922. For refining copper.

1,468,853. TELEPHONE EXCHANGE SYSTEM; A. H. Adams, Galion, Ohio. App. filed May 13, 1920. Machine switches employed for establishing connections.

1,468,871. METHOD AND APPARATUS FOR PASTEURIZING MILK; T. H. Anglim, Dunkirk, N. Y. App. filed Dec. 1, 1921. Milk is electrically heated.

1,468,882. DIMMING SWITCH FOR AUTOMOBILE LIGHTS; C. W. McKee, Harrisburg, and W. T. Taggart, Marietta, Pa. App. filed Nov. 18, 1922. Mounted on steering wheel.

1,468,883. DRIVING ATTACHMENT FOR MAGNETOS; A. Rosner, Springfield, Mass. App. filed Dec. 23, 1921.

1,468,946. RESISTANCE; A. J. Horton, New York, N. Y. App. filed July 28, 1920. Unit type.

1,468,957. COMPOSITION OF MATTER; L. E. Brownell, St. Paul, Minn. App. filed April 17, 1922. Salt, alum and glycerine added to sulphuric acid solution for storage-battery electrolyte.

1,468,982. DUPLEX TELEGRAPHIC SYSTEM; H. W. Sullivan, London, England. App. filed March 22, 1921. Special artificial line to balance actual line.

1,469,015. ELECTRIC BATTERY; L. L. Jones, New York, N. Y. App. filed April 1, 1921. Secondary battery of lead-cell type.

1,469,033. ELECTRIC FURNACE; W. F. Bleecker, Boulder, Col. App. filed July 8, 1920. For reducing tungstic oxides to metallic tungsten.

1,469,037. SOCKET AND SHELL CAP FASTENING; V. R. Despard, Hinsdale, Ill. App. filed July 21, 1917. Lamp socket.

1,469,038. LAMP SOCKET; L. Erikson, Malden, Mass. App. filed June 5, 1920. App. filed June 5, 1920. For use in showcase reflectors.

1,469,043. PROCESS FOR MAKING ELECTRICAL CONTACTS; C. A. Laise, Weehawken, N. J. App. filed May 2, 1921. Method of welding base metal to contact joint metal.

1,469,056. REMINDING DEVICE; G. I. Sullivan, Philadelphia, Pa. App. filed Oct. 18, 1922. Clock arrangement for ringing electrically operated bell.

1,469,075. ELECTRON-DISCHARGE APPARATUS; H. E. Dunham, Schenectady, N. Y. App. filed March 23, 1921. Producing and varying emission of secondary electrons from cold electrode.

1,469,078. SECTION INSULATOR; K. Fritsch, Murnau, Germany. App. filed Feb. 20, 1923. For overhead trolley-wire construction.

1,469,090. VEHICLE DIRECTION INDICATOR; C. R. Krone, Oakland, Cal. App. filed Sept. 21, 1920. Rear direction signal.

1,469,097. SUPPORTING DEVICE; S. S. Mathes, Mansfield, Ohio. App. filed Feb. 9, 1923. For supporting trolley conductors from overhead structure.

1,469,098. CONDUCTOR SUPPORT; S. S. Mathes, Mansfield, Ohio. App. filed May 28, 1923.

1,469,107. BINDING POST; C. Phillips, Jr., Philadelphia, Pa. App. filed March 31, 1922.

1,469,119. ELECTROLYTE GAS AND SPLASH ESCAPE; E. A. Stallings, Wirt, Okla. App. filed Nov. 22, 1921. For storage battery or other electrochemical apparatus.

1,469,127. PPOTECTIVE DEVICE; E. B. Wedmore, Golder's Green, England. App. filed Dec. 10, 1919. Pilot-wire protection of transmission lines.

1,469,134. CONDUCTOR SUPPORT; A. C. Wood, Mansfield, Ohio. App. filed March 10, 1923. For suspending trolley wire from hanger.

1,469,186. ELECTRIC CONNECTOR; E. A. Kuen, Cincinnati, Ohio. App. filed May 24, 1920. For miniature-lamp bulb socket.